SCHILLER

MEDICAL S.A.S.

FRED easyport

Semiautomatic defibrillator (PAD)

Service manual

Version 01.00

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THE ART OF DIAGNOSTICS

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of the service manual

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WARNING

This manual shall be considered to form an integral part of the device described.

This technical manual is intended for qualified personnel and describes the operating, maintenance and troubleshooting procedures for FRED® EASYPORT.

Compliance with its content is a prerequisite for proper device performance and for the safety of the patient and operator.

The manufacturer shall only be liable for the safety, reliability and performance of the device if:

- **assembly, extensions, adjustments, modifications or repairs are performed by the manufacturer or by persons authorised by the manufacturer.**

- **the electrical installation of the facility of use complies with the requirements applicable in the country.**

- **the device is used in accordance with its instructions for use.**

- **the spare parts used are original parts from SCHILLER.**

This manual describes the device at the time of printing.

The supply of this manual does not in any event constitute permission or approval to modify or repair a device.

The manufacturer agrees to supply all the spare parts for a period of ten years.

All rights reserved for the devices, circuits, processes and names appearing in this manual.

The FRED EASY device shall be used as described in the User's Manual. The device may not be used for any purpose that has not been specifically described in the manual, as such use could be hazardous.

SAFETY INFORMATION

- **The product is marked as follows:**

  CE- 0459

  in accordance with the requirements of Council Directive 93/42/EEC relating to medical equipment, based on the essential requirements of annex I of the directive.

- **It fully meets the electromagnetic compatibility requirements of standard IEC 60601-1-2 / IEC 60601-2-4 "Electromagnetic compatibility of medical electrical devices".**

- **The device has undergone interference suppression in accordance with the requirements of standard EN 50011, class B.**

- **In order to optimise patient safety, electromagnetic compatibility, accurate measurement indication and proper device performance, users are advised to use only original spare parts supplied by SCHILLER. Any use of accessories other than original accessories shall be at the exclusive risk of the user. The manufacturer shall not be liable for any damage due to the use of incompatible accessories or consumable supplies.**

- **The manufacturer shall only be liable for the safety, reliability and performance of the device if:**

  - **assembly, configuration, modifications, extensions or repairs are made by personnel from SCHILLER MEDICAL or personnel duly authorised by SCHILLER MEDICAL.**
  - **the device is used in accordance with its instructions for use.**

- **Any use of the device other than as described in the instructions for use shall be made at the exclusive risk of the user.**

- **This manual covers the device version and the safety standards applicable at the time of printing. All rights reserved for the circuits, processes, names, software and devices appearing in this manual.**

- **The quality assurance system in use in the facilities of SCHILLER meets international standards EN ISO 9001 and ISO 13485.**

- **Unless otherwise agreed in writing by SCHILLER, no part of the manufacturer's literature may be duplicated or reproduced.**

Safety symbols used on the device

Danger! High voltage

Conventions used in the manual

Danger:	**indicates an imminent hazard which, if not avoided, will result in death or serious injury to the user (and/or others).**

Caution:	**Warning indicating conditions or actions that could lead to device or software malfunctioning.**

Note:	**Useful information for more effective and practical device operation.** **Additional information or explanation relating to the paragraphs preceding the note.**

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PRECAUTIONS WHILE TESTING THE DEVICE

While testing the FRED® EASYPORT defibrillator, the patient may only be simulated with fixed high-voltage and high-power resistors that are well insulated from the ground or earth. Poorly insulated devices or devices with loose contacts or devices containing components such as spark arresters or electronic flash lamps may never be used as they could irremediably destroy the device.

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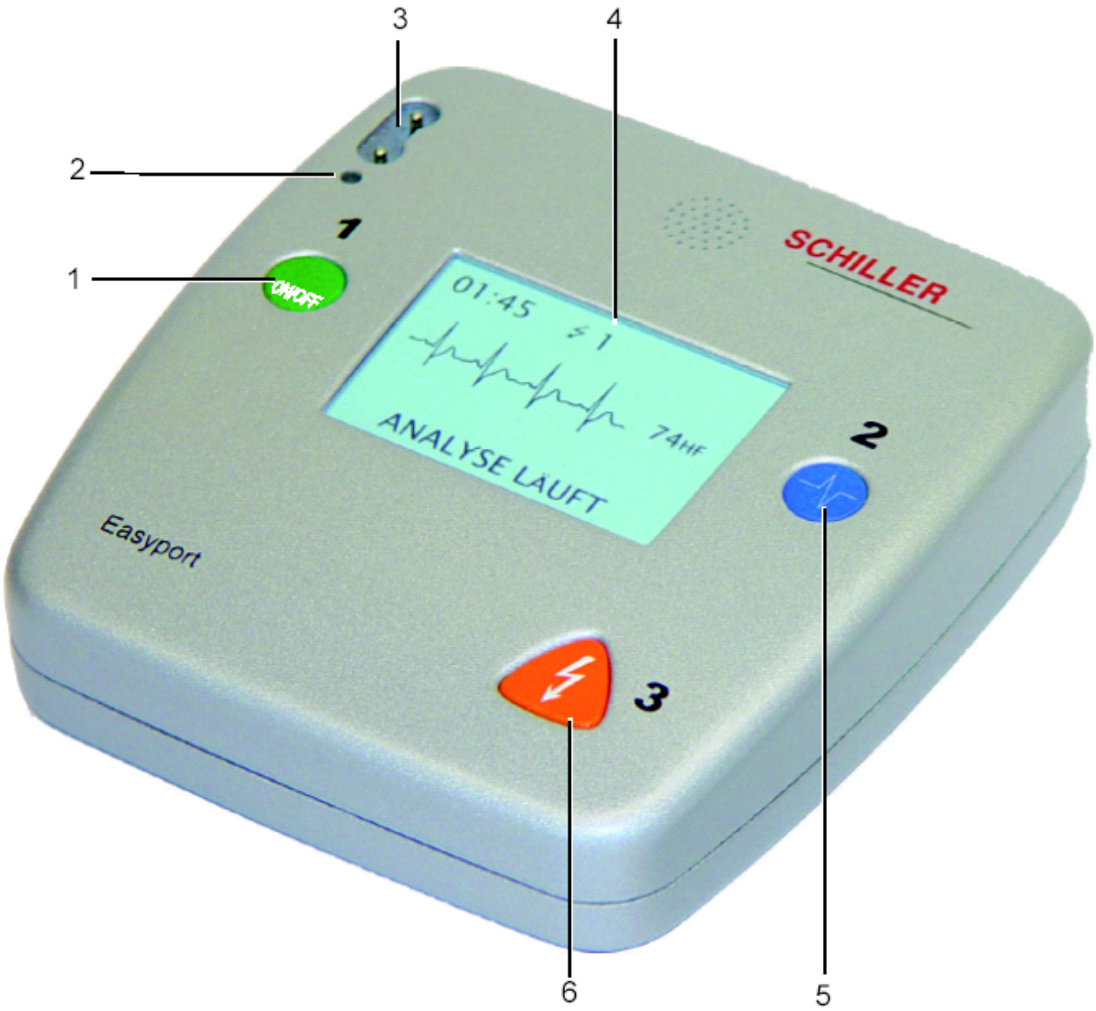
1. Operation

This section briefly outlines the operating of the device. For more detailed information, please refer to the User's Manual.

1.1 Display and controls



1 Green ⏻ key to switch the device on and off (to stop supporting more than 3 seconds).
2 The yellow indicator lamp flashes as long as the electrodes are not in place.
3 Connection of adhesive electrodes
4 Display
5 Blue key to start analysing
6 Key for triggering the defibrillation shock

1.2 Battery and minicard.

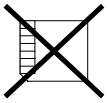
7 Battery 12 V
8 SD-Minicard protection.
9 SD-Minicard

1.3 Explanation of symbols used

Symbols on the device or accessories

	BF type signal input, protected from defibrillation
	Caution! High voltage!
	Expiry date for the use of defibrillation electrodes
	Follow the instructions for use
	Open the electrode packaging
	Remove the protective film
	Single use only. Do not reuse.
	Do not fold the packaging
	Storage temperature range

Symbols displayed on the screen

	Number of shocks given since starting up
	Battery weak (not flickering)
	Memorizing in progress with % progressively incremented with the filling (not flickering)
	Almost full memory, threshold with 98% filling (flickering)
	Problem memory card
	Adult electrode detected
	Child electrode detected
	Time since the machine was started up (minutes and seconds)

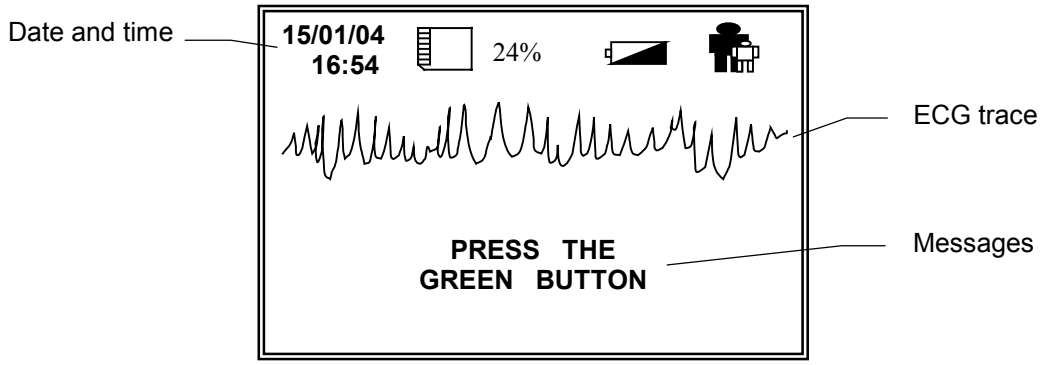
1.4 Device operation.

FRED® Easyport is programmed to operate in four different modes – the test mode followed by the defibrillator mode, the SAAD mode for device configuration and the Standalone mode, used by Manufacturing.

- **Test mode**
  When the device is powered by a cell, it runs a self test every time it is started up. If it does not find any fault and is ready to operate, it switches to the Defibrillator mode.

- **Defibrillator mode (or Nominal mode)**
  When the device is powered by a cell and has passed the self tests, it switches to the defibrillator mode. In this operating mode, the device performs the following operations:
  - Resuscitation algorithm (ERC protocol).
  - Saving of data throughout the procedure
  - Monitoring of system and physiological parameters

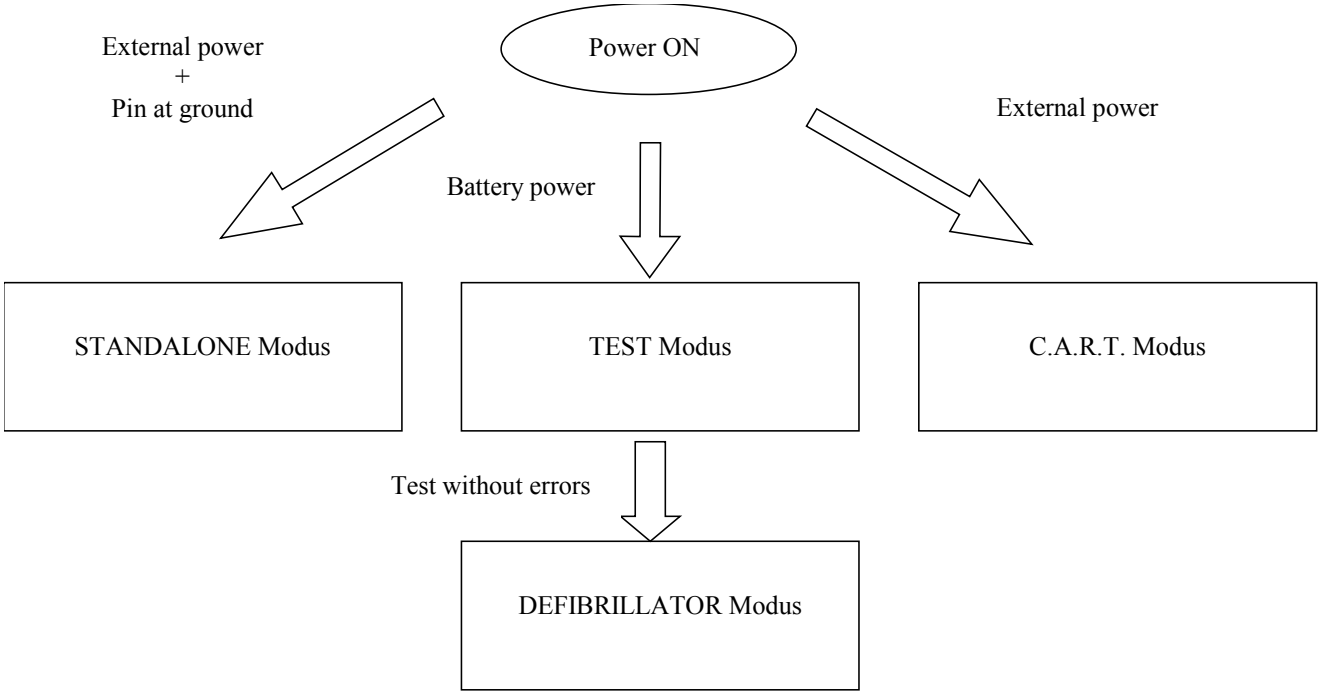
Illustration of the screen in nominal mode



- **SAAD (Setup, Acquisition, Adjustment, Downloading) mode**
  When the device is powered by an adapter unit connected to the FredCo software by means of the serial link and is switched on, it goes into SAAD mode. This mode is used to:
  - Set up and adjust the device
  - View statistics
  - View logs (events describing the use of the device)
  - Download new software versions

- **Standalone mode (Manufacturing)**
  This mode is specific to the manufacturing department of Schiller and is used to test the CPU board by itself. Connector P1 of the CPU board must be connected to the serial link of a test console and pin 4 of P1 must be connected to the ground.
  When the device is in Standalone mode, a message is displayed to inform the operator that the device is not ready for defibrillation. Pressing the keys has no effect, including the On/Off button.

Diagram of the operating modes



In the Defibrillator mode (or nominal mode), **FRED® Easyport** is a cell-operated automated external defibrillator that provides biphasic defibrillation waveforms.

Defibrillation is done by means of disposable adhesive electrodes through which the ECG signals required for the analysis are also collected. Adhesive electrodes are available in child and adult versions. The device recognises the type of electrode applied and selects the appropriate defibrillation energy levels accordingly.

When the electrodes are not connected, the device displays a message to inform the user that the electrodes are not connected or are poorly connected and that they need to be connected to the device. The device remains in that state as long as the electrode problem persists.
If the problem lasts for 30 seconds, the device guides the user to apply CPR.
After five minutes, the device goes off automatically to save power.

The fault is also reported by a second visual indicator, a LED located under the electrode connector. When the fault is observed, the LED lights up to report it. Otherwise, the LED is off.

To use the device, the user is given visual and audio instructions (display and loudspeaker).

Power is supplied by disposable plug-in lithium cells. Their capacity is sufficient for
- 70 shocks at the maximum power value or
- five hours of monitoring (cyclical, 30 minutes on, 30 minutes off) or
- five years of standing by.

1.5 Defibrillation procedure

All the stages are explained to the user through voice prompts and are displayed on the screen. When the ⏻ key is pressed, an introductory text asks the user to stick on the electrodes.

The introductory text is repeated till **FRED® Easyport** recognises that the adhesive electrodes have been applied.

After that, **FRED® Easyport** asks the user to start an ECG analysis and not touch the patient.

Note
- With the signals from the database of the AHA (American Heart Association), **FRED® Easyport** offers precise detection with 98.4 % sensitivity and 99.8% specificity.
- The device can be set up so that it automatically starts an ECG analysis.

During the analysis phase, the software controls the capacitor charge with an energy value equal to that of the first shock. If the analysis program recognises a heart rate that calls for defibrillation, the device asks for a shock.
The heart disorders that call for defibrillation are:
- ventricular fibrillation or
- ventricular tachycardia with a rate of over 180 bpm.

If the device recognises a heart rate that calls for defibrillation, defibrillation is only permitted if the patient has been found earlier to have no pulse or show no signs of circulation.

A second analysis is triggered automatically with a preliminary capacitor charge to the energy value of the first shock.
If the first defibrillation shock has no effect, the device automatically tops up the charge in the capacitor to the energy required for a second shock.

A third analysis is triggered automatically with a preliminary capacitor charge to the energy value of the second shock.
If the second defibrillation shock has no effect, the device automatically tops up the charge in the capacitor to the energy required for a third shock.

Note
The energy values set by default as follows (the technical assistance department of Schiller can set other default values).

Shock	Adult	Child
1	90 J	15 J
2	90 J	30 J
3	120 J	50 J

If the third shock has no effect, **FRED® Easyport** asks the user to alternately apply artificial respiration and heart massage. After one minute, it will recommend a ECG analysis. Depending on the set-up, the new analysis may be automatic.

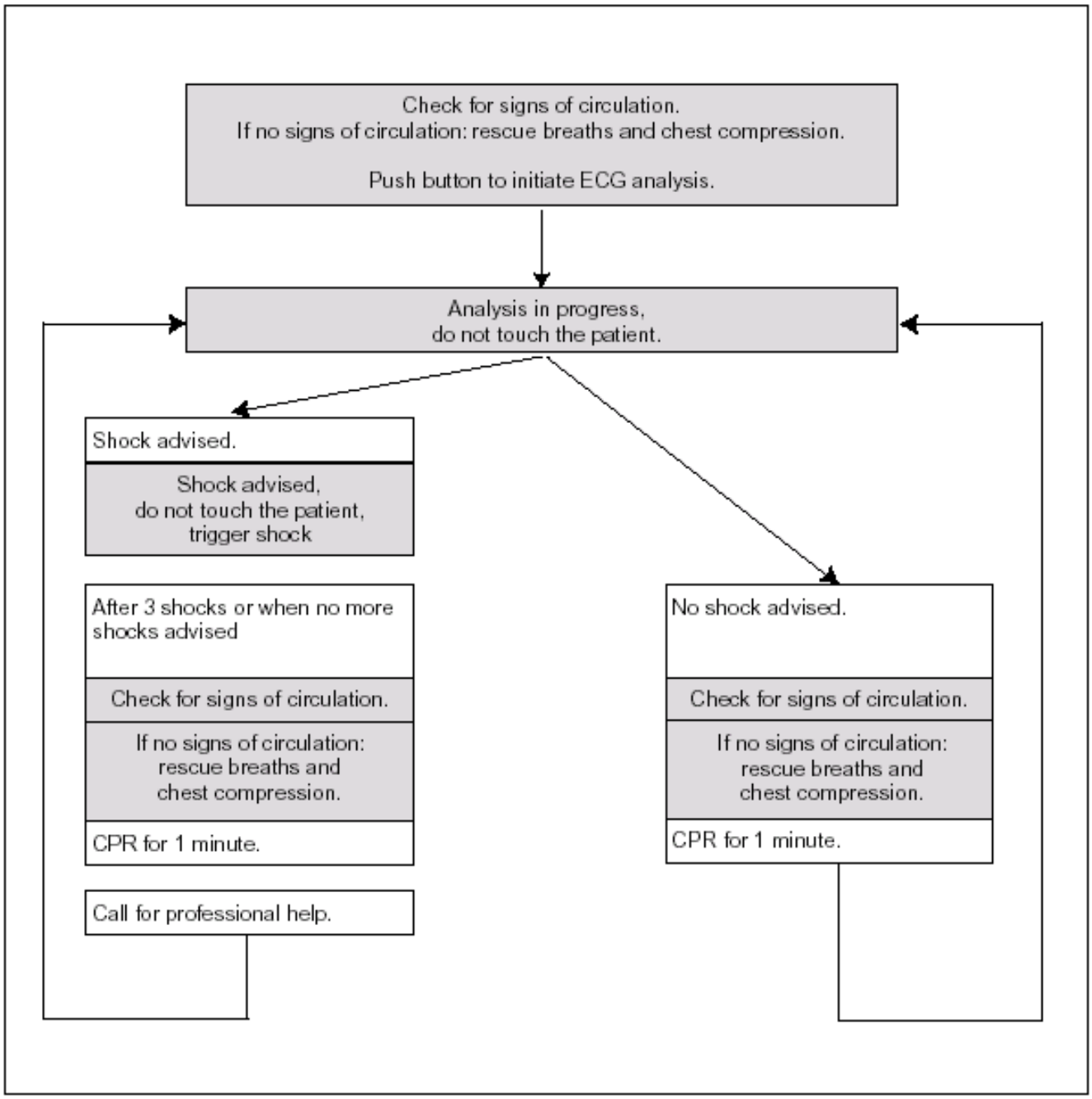
After a successful defibrillation shock, **FRED® Easyport** asks the user to check the respiration and blood circulation of the patient. If there are no signs of circulation, the device recommends the alternate application of artificial respiration and heart message. If there are signs of circulation, the patient is to be laid on his or her side.

If the analysis program does not recognise a heart rate that calls for defibrillation:
- **FRED® Easyport** informs the user that no defibrillation shock is required, and
- asks the user to check respiration and signs of circulation

If there is no sign of circulation, **FRED® Easyport** asks the user to alternately apply artificial respiration and heart massage. If there are signs of circulation, the user is asked to lay the patient on his or her side.
After a minute, **FRED® Easyport** will ask for an ECG analysis once again. Depending on the set-up, the new analysis may be automatic.

The values below may be set up by the technical assistance department of Schiller:
- upon starting up: introductory text or immediate request to apply the adhesive electrodes
- voice volume
- energy levels of shocks 1, 2 and 3, with a distinction between adult and child values
- starting of the ECG analysis by pressing the keyboard or automatic

Procedure chart


Check for signs of circulation.
If no signs of circulation: rescue breaths and chest compression.
Push button to initiate ECG analysis.
Analysis in progress,
do not touch the patient.
Shock advised.
Shock advised,
do not touch the patient,
trigger shock
After 3 shocks or when no more shocks advised
Check for signs of circulation.
If no signs of circulation:
rescue breaths and
chest compression.
CPR for 1 minute.
Call for professional help.
No shock advised.
Check for signs of circulation.
If no signs of circulation:
rescue breaths and
chest compression.
CPR for 1 minute.

1.6 Recording (optional)

For information, the memory card can save:
- half an hour of ECG
- 500 events relating to the procedure (see overview opposite).

In the nominal operating mode, the device records different types of information throughout the procedure. Recording starts when the device is powered up and runs in the nominal mode and stops when the device is switched off.

- Saving in progress indicator. **24%** This symbol is displayed (steady display) and the percentage is incremented as the memory card is filled up.

- Memory almost full indicator. **99%** This symbol flashes when the recording memory is almost full. That does not stop the ERC protocol. The limit at which the memory is almost full is 98 %.

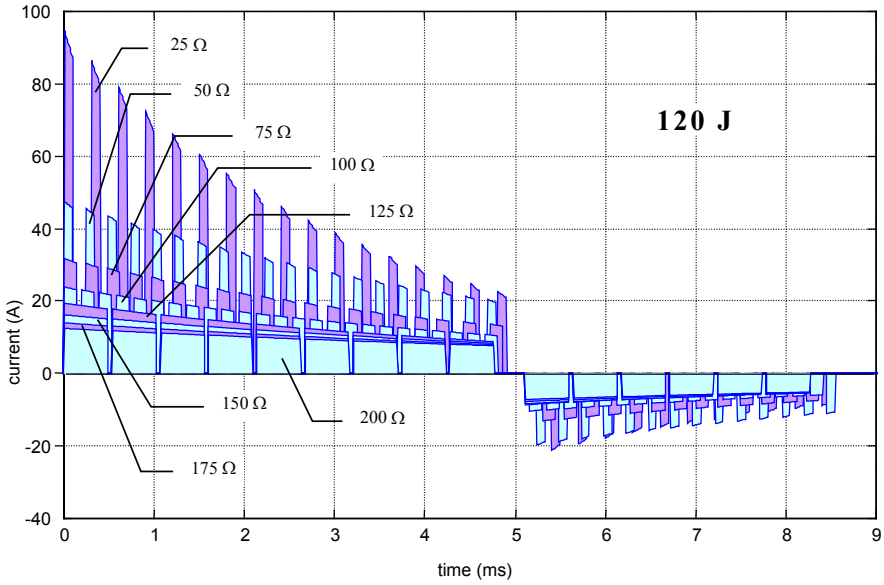
- Memory full or no card indicator. No memory symbol is displayed.

- Indicator of a problem with the procedure recording memory. This symbol flashes when the recording memory is not accessible (write protected, hot insertion, electronic problem etc.). That does not stop the ERC protocol.

1.7 Technical specifications

- Form of the defibrillation pulse
  - Biphasic impulse of defibrillation pulsated with compensation of patient impedance.

- Standard energy settings::
  - Adult (discharge in 50 Ω) : 90 -90 -120 J
  - Child (automatic switch when child electrodes are connected) : 15 -30 -50 J
  - The energy levels can be configured by the technical assistance department of Schiller if the standard values need to be changed :
    15 - 30 - 50 - 70 - 90 - 120 J (Adult)
    15 - 30 - 50 - 70 (Child)
  - Tolerance at 50 Ω: ± 3 J or ± 15 % (whichever is greater).



- Automatic charge control after a shock is recommended following an analysis

- Patient resistance 30 to 200 Ω.

- Charge duration, from the time a shock is recommended up to the time when the device is ready:
  < 10 s

- Cycle time between two shocks:
  < 20 s

- Indication that the devices is ready to deliver a shock: key goes on.

- The shock is delivered with key

- Internal safety discharge:
  - after the self test phase of the defibrillator circuit
  - if the CPU host selects a 0-J energy value
  - if the PIC detects that the cell is low during the charge phase (UBATT ≤ 7,5V)
  - if the energy stored during the hold phase does not match the energy selected
  - when the device is switched off or when the cell is removed during operation

- The shock is delivered with single-use adhesive electrodes applied in the anterior / anterior-lateral positions

- BF type defibrillation electrode connector.

- Defibrillation electrodes:
  - Adult electrodes: Active area 50 cm²
  - Child electrodes: Active area 15 cm²
  - Electrode cable length: 1,20 m

- VT / VF recognition:
  - Shock recommendation: for VF and VT (VT > 180 bpm)
  - Sensitivity: 98.4 %
    Specificity: 99.8 %. These values have been found with the AHA database, which contains cases of VF and VT with and without artefacts.
  - Conditions required for ECG analysis:
    Minimum amplitude for the signals used > 0.15 mV , signals of < 0.15 mV are considered to show asystole.
  - Definition:
    Sensitivity: Correct detection of heart rates for which defibrillation shocks **are** recommended
    Specificity: Correct detection of heart rates for which defibrillation shocks **are not** recommended

- Display:
  - LCD, 60 x 40 mm, high definition, with EL backlighting, display of text and icons

- Recording of the use of the device (optional)
  - ECG recording (half an hour)
  - Event recording (500 events)

- Capacité de la pile au lithium
  - 70 chocs à puissance maximale ou
  - Utilisation du moniteur pendant 4 heures (cyclique 30 minutes en marche, 30 min arrêté)
  - 5 ans de veille.
- Lithium battery capacity
  - 70 shocks at the maximum power rating or
  - Use of the monitor for four hours (cyclical, 30 minutes on, 30 minutes off)
  - Five years standing by.

- Environment conditions:
  - Transport / storage:
    Temperature - 20 to + 50 °C
    Relative humidity of air 0 to 95 %, non condensing
    Atmospheric pressure 500 - 1060 hPa
  - Use:
    Temperature 0 to + 50 °C
    Relative humidity of air 0 to 95 %, non condensing
    Atmospheric pressure 500 - 1060 hPa

- Electromagnetic compatibility:
  - The **FRED easy®** device only uses radio frequency range energy for its internal functions. It is treated against interference in accordance with standard CISPR 11 class B
  - The **FRED easy®** device can be subjected to the following interference without any adverse effect on its functioning:
    - ❖ electrostatic discharges of up to 8 kV.
    - ❖ energy in the radio frequency range up to 20 V/m (80 - 2500 MHz, 5 Hz modulated).
    - ❖ magnetic fields of 100 A/m, 50 Hz

- Dimensions and weight:
  - Width : 126 mm
  - Depth : 133 mm
  - Height : 35 mm
  - Approximate weight : 490 g (with battery)

2. Testing and maintenance

This section describes the test and maintenance procedures recommended for pour **FRED® Easyport**.

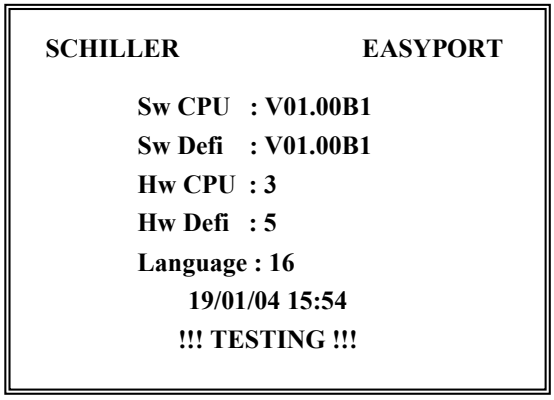
2.1 Functional testing

Functional testing is performed by the automatic test function. In order to ensure that the device is operating correctly, tests are conducted when it is switched on in the nominal mode (SAD mode).

2.2 Test mode:

Self tests are conducted automatically when the device is powered by the cell and is switched on by pressing the ⏻ On/Off key. The operator does not see the tests. No message describing the tests is displayed when the device is running them.

A starting up screen is displayed during the self test procedure with the following information:



Language Code							
1	English	10	Finnish	19	Turkish	28	Walloon
2	French	11	Russian	20	Japanese	29	Latvian
3	German	12	Chinese	21	Hebrew	30	Tahitian
4	Spanish	13	Korean	22	Bulgarian	31	Brazilian
5	Italian	14	Romanian	23	Arabic	32	Slovak
6	Dutch	15	USA	24	Czechoslovakian	33	Polish
7	Swedish	16	Austrian	25	Quebec French		
8	Portuguese	17	Danish	26	Hungarian		
9	Norwegian	18	Greek	27	Flemish		

The tests cover the following functions:

1. Hardware number test
2. Acquisition system test: ECG & patient impedance
3. Defibrillator test: communication channel and defibrillation hardware module
4. Settings storage memory test
5. Real time device clock test
6. Cell voltage test. The cell voltage is tested by charging the capacitor
7. LCD display test
8. Voice prompt system test

Note

Failure to pass tests 1 – 4 disables the device, which indicates the failed test till it is switched off.
Failure to pass tests 5 and 6 does not disable the device.
Simultaneous failure to pass tests 7 and 8 disables the device.

If the tests are passed or if the errors are not of the disabling type, the device goes into Defibrillator mode.

2.3 SAAD mode

This operating mode is used to set up the device, extract statistics or download software. The cell is replaced by the adapter unit and the downloading unit connected to the FredCo software is to be used.

2.3.1 Setting up and adjustments

The configurable settings are:

- Date and time + format + summer/winter time
  - Date format: DD/MM/YYYY or MM/DD/YYYY or YYYY/MM/DD
  - Time format: 12 or 24 hours
- Defibrillation energy values
- ECG display
- Voice prompt volume level
- Analyse button use
- CPR phase
- Motion detection
- Language for the display and audio messages of the ERC protocol
- Device serial number
- Hardware version number
- Shock counter (charge capacitor wear)
- ERC 1 minute / 3 minute protocol selection
- Device identification string

2.3.2 Statistics

The list of data stored below is not exhaustive and will develop to keep pace with needs:

- Total device running time
- Status of the mini SD card flash memory – card size, space occupied, number of events logged
- Periodic test log (last 30 tests as a minimum): date, time, result, description of the error
- Uncontrolled switching off (last 30 times as a minimum): cell low, electrode fault for more than 5 minutes – date and time
- Number of charges per energy value
- Number of shocks per energy value.
- Total running time of the high-voltage converter
- Etc.

The data cannot be erased by means of a device button. They may be erased by a command from the serial link.
The data need to be made secure. In particular, they must not be destroyed when the device is switched off suddenly because the cell is removed. The data are only saved when the device undergoes a controlled shut-down.

2.3.3 Downloading

The downloading function is used to upgrade the firmware in the device. The software provides the language. To change languages, the firmware with the required language needs to be downloaded.

2.4 Systematic checking before use

Before each use, the device must undergo a visual inspection, including the cables, connectors and electrodes.

If a fault or malfunctioning likely to harm the safety of the patient or the user is found, the device may not be started up again before it is repaired.

Systematic inspection before each use
- Device housing check
- No mechanical damage
- No liquid penetration into the device
- Control button and connector check

2.5 Cleaning and disinfection

Important: **Switch off the device before cleaning. Remove the cell before starting to clean the device in order to ensure that the device does not start up accidentally. Before cleaning, also disconnect the defibrillation electrode cables from the device.**

No liquid must enter into the device. If that does happen, the device may not be used before it is checked by the after-sales service department.

Users are strongly advised against cleaning the devices or electrodes with agents such as ether, acetone, esters or aromatic chemicals.
Never use phenol-based cleaners or cleaners containing peroxide derivatives to disinfect the surfaces of the device housing.

- Systematically dispose of the single-use electrodes immediately after use in order to ensure that they are not reused by mistake (hospital waste).
- Before cleaning the electrode cables, disconnect them from the device. Clean and disinfect them by wiping them with a piece of gauze moistened with cleaner or disinfectant. Never immerse the connectors in any liquid. Use any cleaning or disinfectant solution that is commonly used in hospitals.
- Proceed likewise with the device housing, with a cloth moistened with cleaner or disinfectant. No liquid may enter the device during cleaning.

3. Troubleshooting

This section describes how to locate failures if **FRED® Easyport** shows any signs of malfunctioning. If you have trouble locating or correcting the fault, contact the after-sales service department of Schiller.

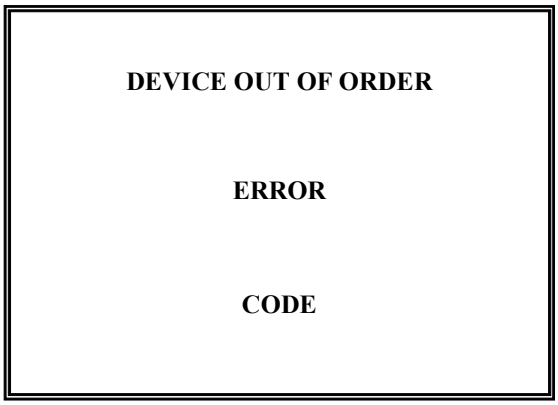
Precautions to be taken for troubleshooting

All tests with **FRED® Easyport** defibrillators shall be done exclusively with fixed resistors with high voltage and power ratings to simulate the patient. The resistors shall be correctly insulated from the ground and the earth. Any use of incorrectly insulated systems or systems with loose contacts or containing components such as spark gaps or electronic flash lamps is strictly forbidden as that could irreversibly damage the device.

Danger: **Before opening the device for work, FIRST MAKE SURE THAT THE HV CAPACITOR HAS BEEN DISCHARGED FULLY.**

ERROR	OBSERVATION	POSSIBLE CAUSES	CORRECTIVE ACTION
! ! ! TESTING ! ! ! Not displayed on the screen		1. Check button cell on CPU (out of order or flat) 2. Check if F1 fault on Defibrillator board 3. CPU board fault 4. Defibrillator board fault	1. Replace button cell 2. Replace fuse 3. Replace CPU 4. Replace defibrillator board
Electrodes not connected and LED under the electrode connector off		1. Defibrillator board fault 2. CPU board fault	1. Replace defibrillator board 2. Replace CPU board
Electrodes connected to simulator with 50-ohm impedance, but the LED stays on		1. Defibrillator board fault 2. CPU board fault	1. Replace defibrillator board 2. Replace CPU board
No voice prompts		1. Speaker fault 2. CPU board fault	1. Replace speaker 2. Replace CPU board
Orange Shock key will not light up		1. CPU board fault	1. Replace CPU board
No memory card recording		1. Memory card fault 2. CPU board fault	1. Replace memory card 2. Replace CPU board
Loss of date and time		1. Button cell fault 2. CPU board fault	1. Replace button cell 2. Replace CPU board

If any error is detected, **FRED® Easyport** will indicate the error code and the screen will be as shown below. To identify the error, refer to the table below or use the FredCo software.



Note: **If an error message is displayed, note down the error number and restart the device to make sure that the error is not due to an isolated program error.**

List of error messages			
CODE	**MESSAGE**	**POSSIBLE CAUSES**	**CORRECTIVE ACTION**
100-1	Err: System	- CPU board problem - Defi board problem	- Replace CPU board - Replace CPU board
100-100	Err: ADC	- ADC problem (U36) on CPU board	- Replace CPU board
100-101	Err: ADC selftest 1	- ADC problem (U36) on CPU board	- Replace CPU board
100-102	Err: ADC selftest 2	- ADC problem (U36) on CPU board	- Replace CPU board
100-103	Err: ADC selftest 3	- ADC problem (U36) on CPU board	- Replace CPU board
100-200	Err: Defi	- Defi board problem	- Replace Defi board
100-201	Err: Defi invalid Hard version	- Hardware version of Defi board not compatible	- Upgrade Defi board hardware
100-202	Err: Defi invalid Soft version	- Software version of Defi board not compatible	- Upgrade Defi board software
100-203	Err: Defi autotest precharge	- µC problem (U9) on Defi board	- Reload program - Or replace Defi board
100-204	Err: Defi reference voltage	- Voltage reference problem at U7 of Defi board	- Replace Defi board
100-205	Err: Defi ADC	- µc problem (U9) on Defi board	- Reload program - Or replace Defi board
100-206	Err: Defi charge transistor	- Q6 problem on Defi board	- Replace Defi board
100-207	Err: Defi security discharge	- Safety discharge circuit problem on Defi board (U6, R127, D17 - D19)	- Replace Defi board
100-208	Err: Defi Eprom	- µc problem (U9) on Defi board	- Reload program - Or replace Defi board

List of error messages			
CODE	**MESSAGE**	**POSSIBLE CAUSES**	**CORRECTIVE ACTION**
100-209	Err: Defi shock button	- Shock button problem - Or U8 problem	- Check and replace Shock button if needed - Or replace Defi board
100-210	Err: Defi Com	- µc problem (U9) on Defi board	- Reload program - Or replace Defi board
100-211	Err: Defi Discharge HV reset	- Problem with HV circuit	- Replace Defi board
100-212	Err: Defi bad stored energy	- Problem with energy stored on Defi board	- Replace Defi board
100-213	Err: Defi discharge Hw defect	- Problem with HV circuit on Defi board	- Replace Defi board
100-214	Err: Defi discharge bad energy	- Problem with discharge energy on Defi board	- Replace Defi board
100-215	Err: Defi battery voltage	- Problem with lithium cell	- Replace cell
100-217	Err: Defi CPU	- µc problem (U9) on Defi board	- Reload program - Or replace Defi r board
100-218	Err: Defi program integrity	- µc problem (U9) on Defi board	- Reload program - Or replace Defi board
100-220	Err: Defi charge circuit	- HV generator problem (U3) on Defi board	- Replace Defi board
100-221	Err: Defi problem IGBT	Problem with IGBT module (U6) on Defi board	- Replace Defi board
100-222	Err: Defi power supply	- Problem with + 5 V power supply	- Replace Defi board - Or replace CPU board
100-300	Err: LCD	- Problem with LCD management on CPU board	- Replace CPU board
100-400	Err: OKI	- Problem with OKI (U26) on CPU board	- Replace CPU board
100-500	Err: Flash	- Problem with Flash (U6) on CPU board	- Replace CPU board
100-501	Err: Read Flash	- Problem with Flash reading (U6) on CPU board	- Replace CPU board
100-502	Err: Write flash	- Problem with Flash writing (U6) on CPU board	- Replace CPU board
100-600	Err: RTC	- Problem with RTC (U16) on CPU board	- Replace CPU board
100-700	Err: Hardware version	- Hard and software version not compatible on CPU board	- Load correct software version - Or Upgrade CPU board
100-701	Err: Hw version invalid => 0	- Problem on R81 of CPU board	- Check if R1 = 100 k on CPU board
100-702	Err: Hw version invalid => 47	- Problem on R82 of CPU board	- Check R2 on CPU board; it must adjust to the hardware version.
100-800	Err: Standalone mode	- Problem with PB15 at U1 of CPU board, connected to the ground	- Check if LP1 is not shorted - Or check if pin 4 of P1 is not connected to the ground
100-900	Err: ECG amplification chain	- Problem with ECG amplification chain on Defi board or CPU board	- Replace CPU board - And/or replace Defi board

4. Replacement of parts

This section addresses the dismantling of **FRED® Easyport** for replacing defective parts. The warnings below apply to all work on the components inside the device.

Danger:	**FRED® Easyport is a defibrillator with an HV capacitor capable of carrying fatal voltages. The device may only be dismantled by specially authorised and trained personnel.** **Before opening the device to work on it, MAKE SURE THAT THE CAPACITOR HAS BEEN DISCHARGED**

Important:	**Before opening the device, take the cell out of its housing.**

Important:	**The device contains circuits sensitive to electrostatic discharge. All work on FRED® Easyport shall be performed in accordance with ESD rules. The work shall be performed on an antistatic mat connected to the earth and the operator shall wear an antistatic strap that is connected to the mat. Remove the antistatic strap while working on the high-voltage part of the defibrillator.**

Important:	**Each defibrillator and CPU board has its own hardware number. The list of permitted combinations (defibrillator and CPU hardware number) is available from Schiller Medical.** **The hardware version numbers are displayed when the device is started up during the self test phase.**

Important:	**Every time the device is opened, it must undergo an overall test when it is closed.**

4.1 Device disassembly procedure

While disassembling the device, follow the instructions below:

1. Remove the lithium cell from its housing.

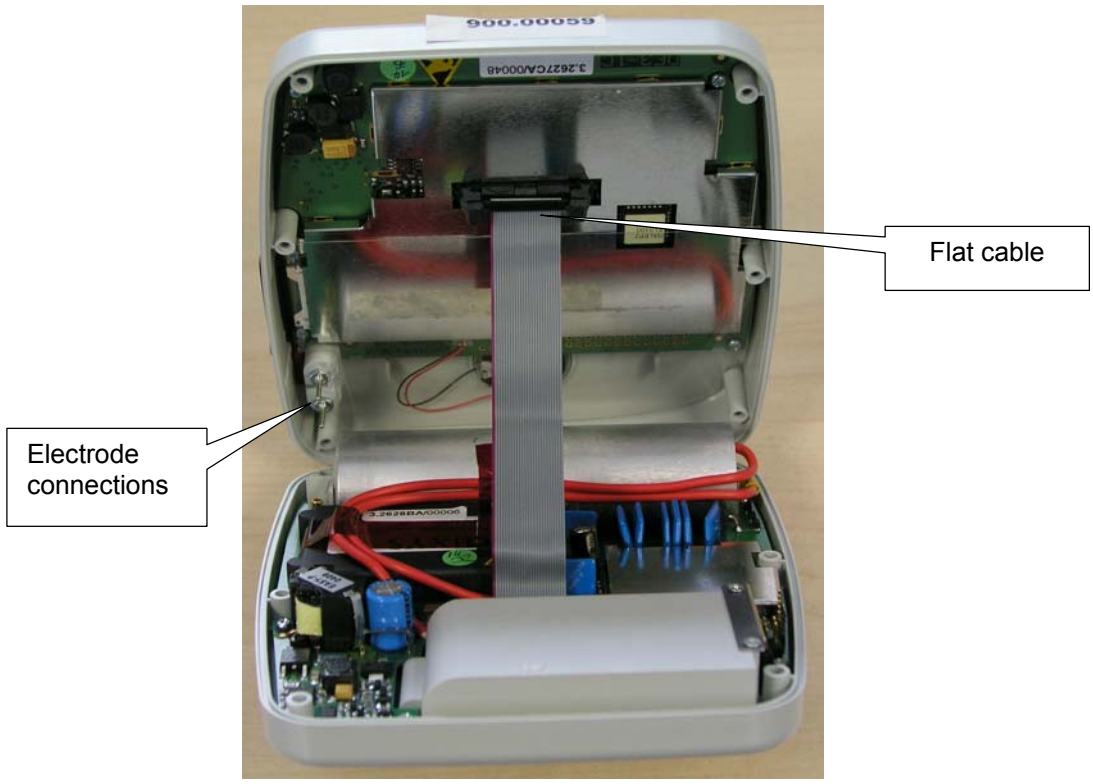
2. Disconnect the electrode cable.

3. Turn the device over (LCD screen down), take off the protective caps on the screws and unscrew the six assembly screws of the upper and lower halves of the housing.

4. After removing the six screws, turn the device over once again (LCD screen toward you).

5. The upper half of the housing may now be pulled off gently. The electrode connections to the left-hand side may offer some resistance.

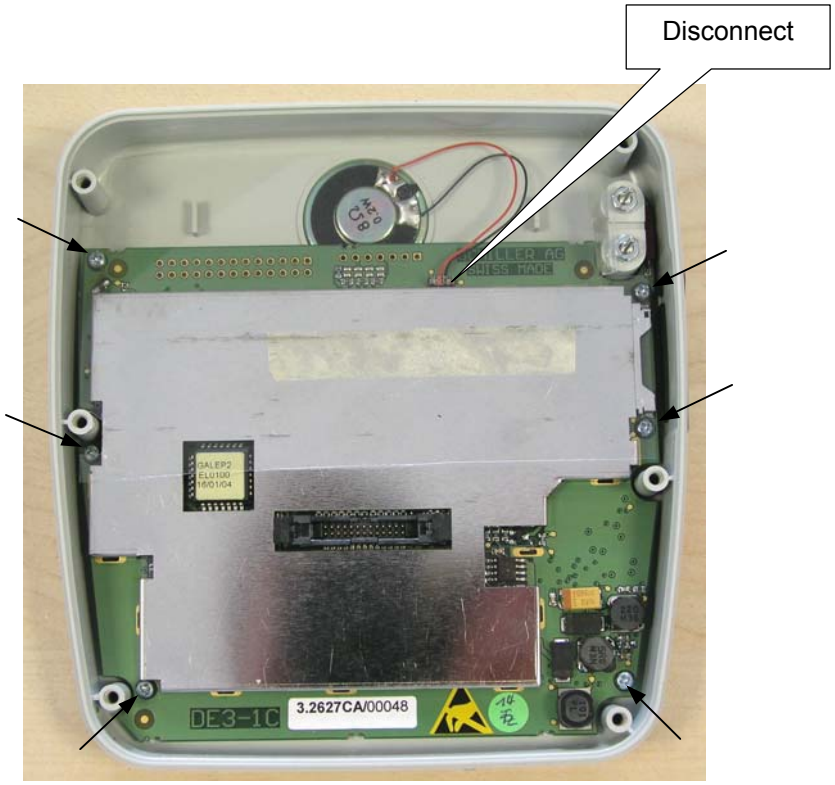
6. Disconnect the flat cable connector.



4.2 Working on the CPU circuit

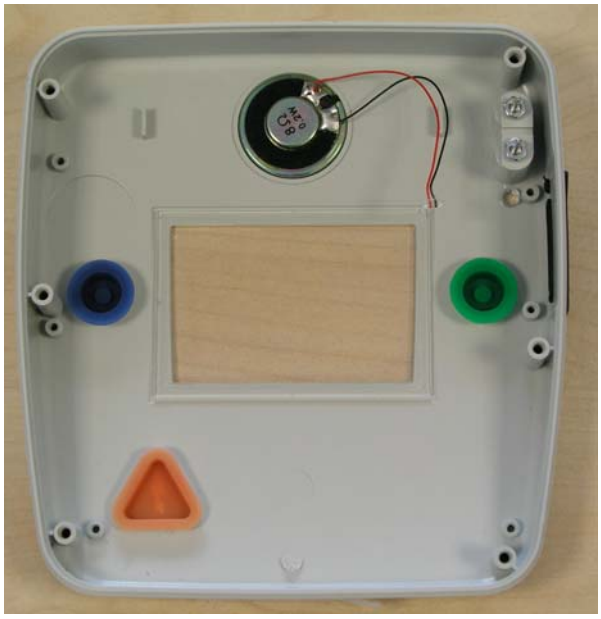
To remove the CPU, follow the instructions below:

1. Disconnect the speaker and take off the six screws shown by an arrow.



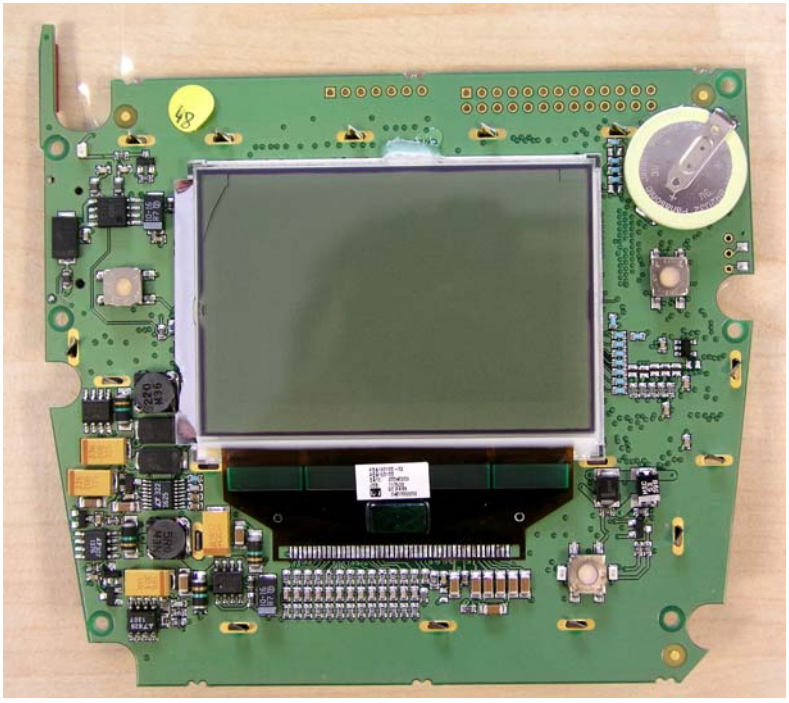
Important:	**Do not lose the control button caps placed in the upper part.**

2. The speaker is glued into its slot. If needed, prise it out with a screwdriver.



Important:	**This circuit contains components sensitive to electrostatic discharge. The operation above shall be performed in accordance with ESD rules.**

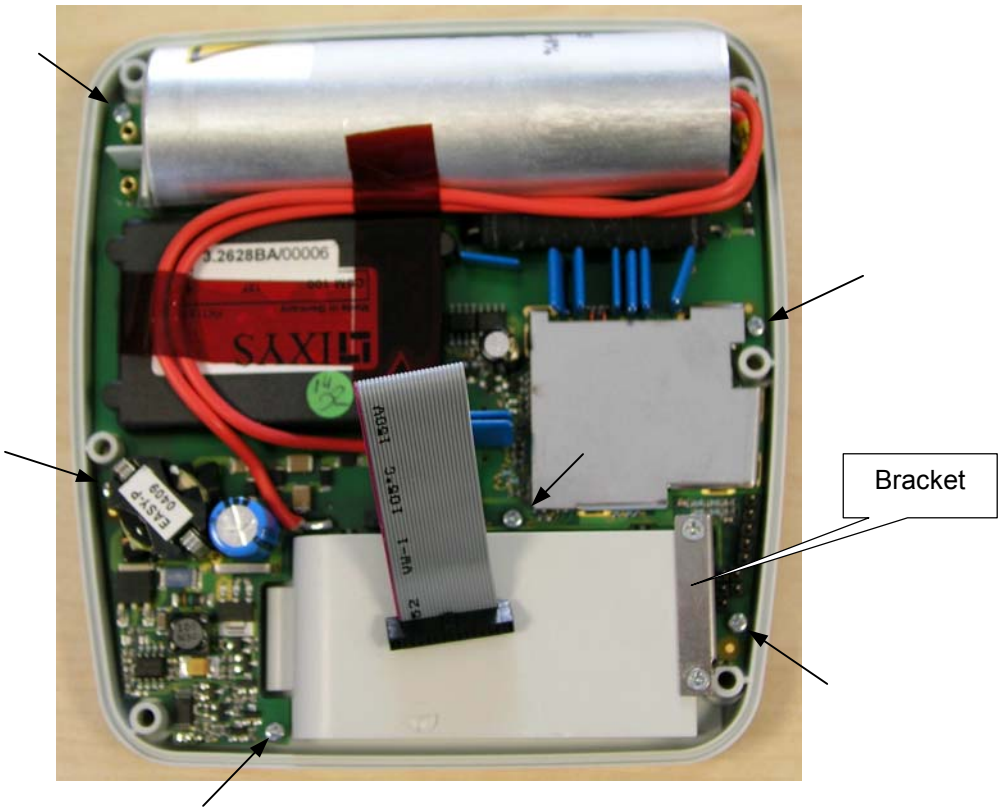
3. To replace the button cell, you will need to remove the shielding.



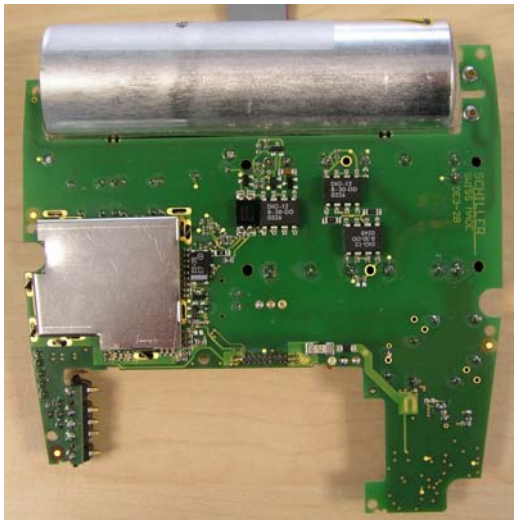
4.3 Working on the defibrillator circuit

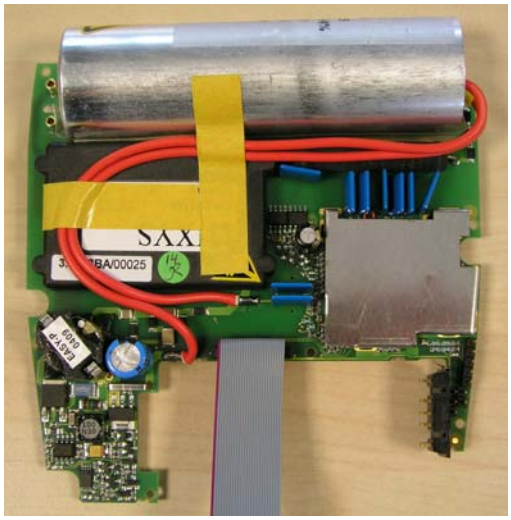
To remove the defibrillator circuit:

1. Take off the six screws marked by an arrow.
2. Take off the bracket that holds the cell connector.



Important:	**This circuit contains components sensitive to electrostatic discharge. After disconnecting the PCB from the device, follow ESD rules.**





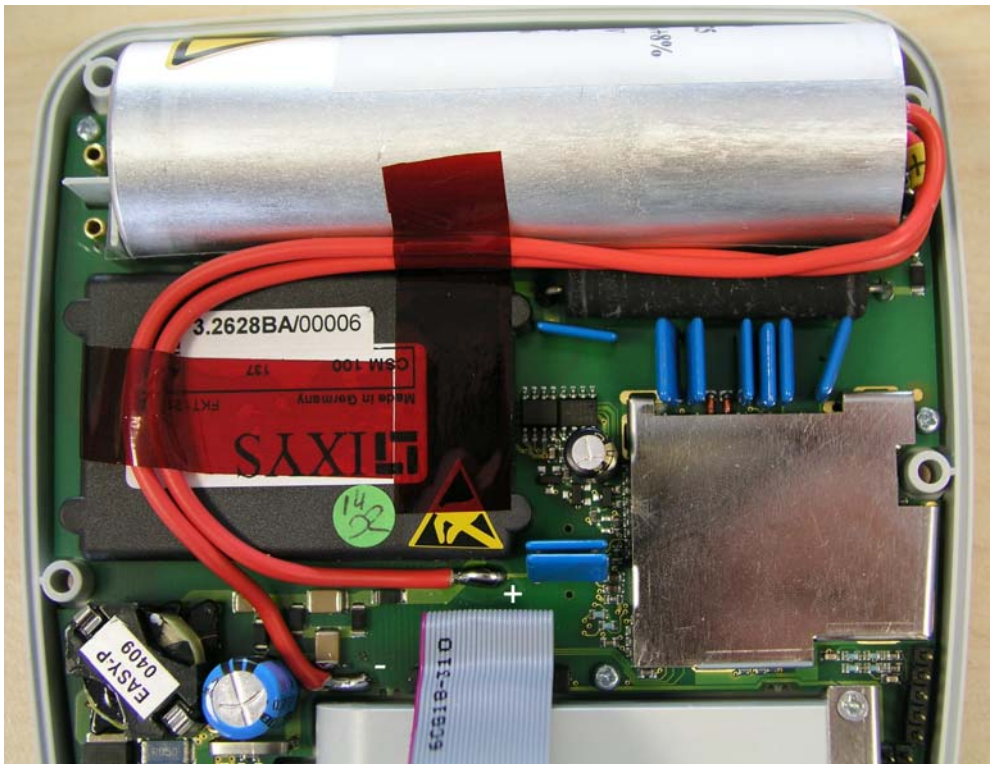
4.4 *Replacing the HV capacitor*

Warning:	**This operation concerns the HV capacitor, which may be charged to a fatal voltage. Before any work, make sure that the HV capacitor has been fully discharged. Never touch the terminals of the HV capacitor directly. The HV capacitor may only be replaced by specially authorised and trained personnel.**

The replacement of the HV capacitor is required very rarely, as the life of the capacitor is extremely long. However, if needed, the HV capacitor may be replaced in accordance with the instructions below:

IMPORTANT! FIRST CHECK IF THE HV CAPACITOR IS FULLY DISCHARGED!

1. Separate the two HV wires



After you remove the (fully discharged) HV capacitor from the lower part, short its two terminals with conductive wire.

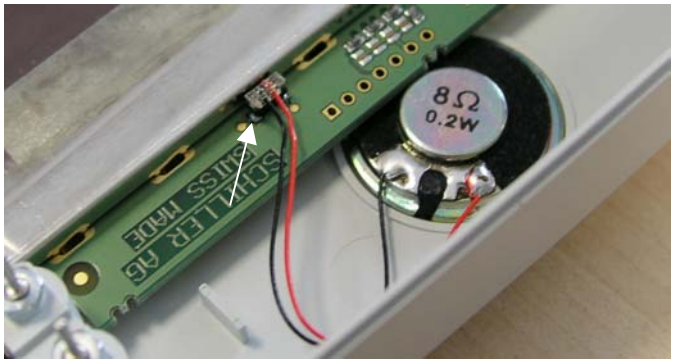
While replacing the HV capacitor, place it in its housing and then solder the cables, taking care to follow the polarity. Also follow the cable path.
Make sure that nothing has been forgotten before restarting the device.

Important:	**This operation concerns a key component of the HV part of the device and may only be performed by specially authorised personnel with training in FRED® Easyport.** **A test of the energy delivered is required.**

4.5 Reassembling the device

Reverse the operations to reassemble the device.

1. Do not forget to connect the speaker to the CPU.

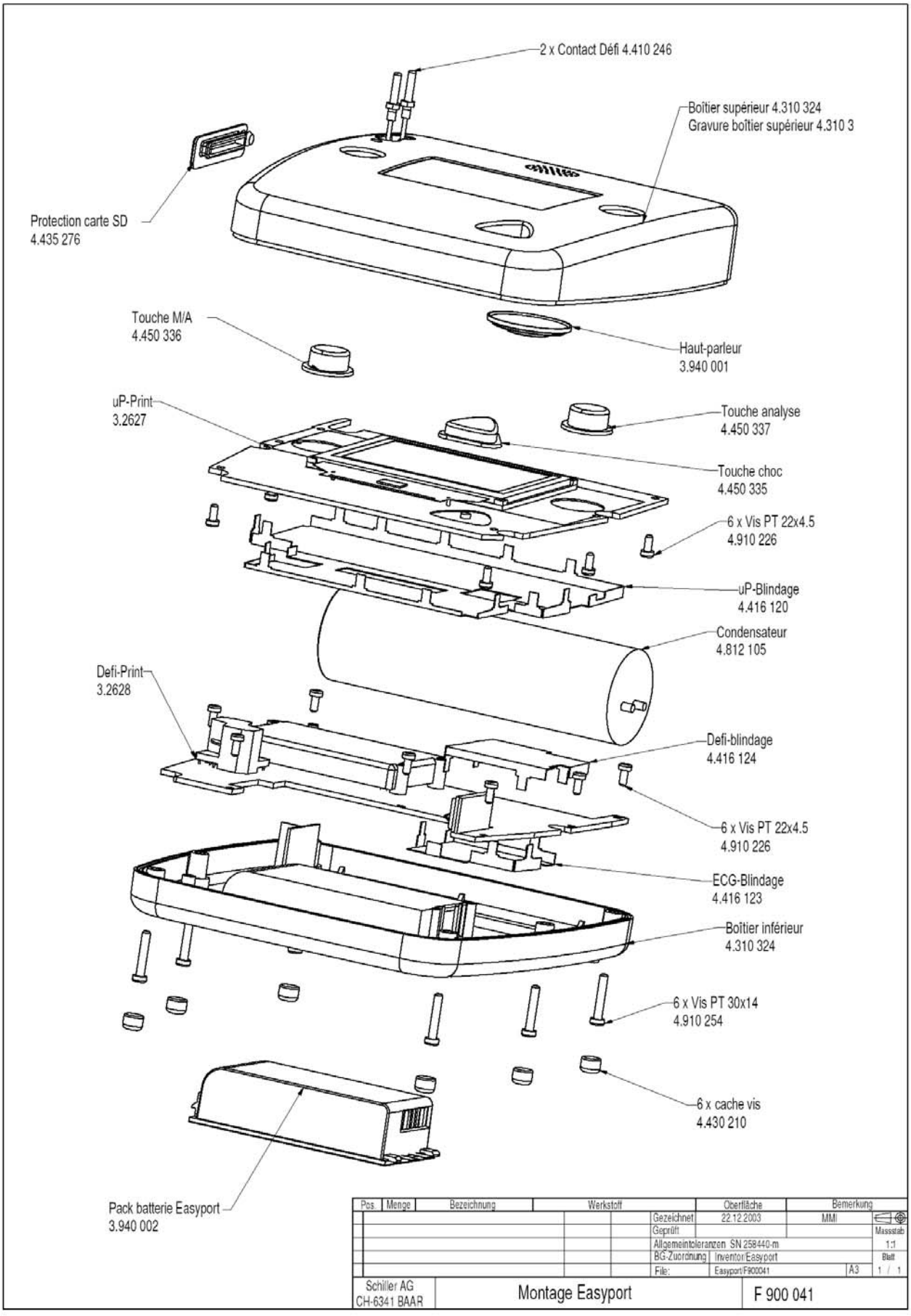


2. Take care while connecting the HV contacts.

4.6 Replacing parts

Warning:	**Parts may only be replaced by personnel who have been specially trained and authorised by Schiller.** **Also, use only original Schiller replacement parts.**

Note:	While ordering a new part from Schiller, state the type of device and the serial number provided under the device. Then specify the item code of the part to be replaced.


2 x Contact Défi 4.410 246
Boîtier supérieur 4.310 324
Gravure boîtier supérieur 4.310 3
Protection carte SD
4.435 276
Touche M/A
4.450 336
Haut-parleur
3.940 001
uP-Print
3.2627
Touche analyse
4.450 337
Touche choc
4.450 335
6 x Vis PT 22x4.5
4.910 226
uP-Blindage
4.416 120
Condensateur
4.812 105
Defi-Print
3.2628
Defi-blindage
4.416 124
6 x Vis PT 22x4.5
4.910 226
ECG-Blindage
4.416 123
Boîtier inférieur
4.310 324
6 x Vis PT 30x14
4.910 254
6 x cache vis
4.430 210
Pack batterie Easyport
3.940 002
Pos. Menge Bezeichnung Werkstoff Oberfläche Bemerkung
Gezeichnet 22.12.2003 MMI
Geprüft
Allgemeintoleranzen SN 258440-m
BG-Zuordnung Inventor/Easyport
File: Easyport/F900041 A3
Massstab 1:1
Blatt 1 / 1
Schiller AG
CH-6341 BAAR
Montage Easyport
F 900 041

5. Technical description of boards

5.1 FRED® Easyport

General description of FRED® Easyport

FRED® Easyport is technically divided into two subassemblies:

- The defibrillator board, which carries the various digital processing functions specific to the defibrillator, analogue processing functions and the high-voltage circuit of the defibrillator.

- The CPU board, which carries the various digital processing functions, storage, auxiliary power supplies and control, monitoring and display systems.

  The two boards communicate electrically with each other through a flat cable with a 26-pin connector at its end (P2).

Control, monitoring, power supply, display and recording systems

The various control, monitoring and display systems of the CPU board are:

- LCD screen that acts as the visual interface between **FRED® Easyport** and the user
- On/Off key for switching the device on and off
- Analyse key to start an analysis of the patient's ECG signal
- Shock key to deliver the defibrillation shock
- Orange LEDs showing the Shock key and providing an added visual user interface
- Electrode fault LED showing where the defibrillation electrodes are to be connected. It also shows electrical circuit continuity.
- A speaker to play the prompts intended for the user
- A removable memory card of the mini SD card type for recording the ECG signal and procedure events

Set-up and downloading accessory

- A special unit that replaces the cell unit and has a mini DIN connector for a serial link with an external PC is used to download programs and set up **FRED® Easyport**. During these operations, the device is powered by an external power source through the same connector.

5.2 CPU, part no. 3.2627

The paragraphs below describe the different functions of the CPU board.

General description:

Figure ***Diagram 1***, provides an overview of device functions.
The various subassemblies are represented in charts 2 to 7.

The pushbuttons and the LCD display module are directly soldered onto the CPU board.

The CPU board controls and monitors the following basic functions:

- Main clock
- Generation of intermediate clocks
- Real time clock
- Data bus amplification
- Address bus amplification
- SDRAM working memory
- Flash memory (program, set-up data, incident log)
- Power from the 26-pin P2 connector (for flat cable)
- Auxiliary power supplies
- 3.3-V voltage supervisor (Coldfire power supply)
- Monitoring of auxiliary voltages
- Monitoring of power supply cell voltage
- Device power on/off (On/Off key)
- Start of analysis (Analyse key)
- Recognition of electrode type (child/adult)
- Delivery of defibrillation shock (Shock key)
- RS232 serial links through connector P2 (26 pins)
- Communication between Coldfire and defibrillator PIC
- Mini SD Card memory card interface
- LCD display interface
- CPU hardware configuration
- ADPCM decoder for voice prompts
- Audio amplifier for voice prompts
- Analogue to digital converter
- ECG signal analogue processing

Description of subassemblies

Microcontroller

Figure ***Diagram 2*** shows the MCU (microcontroller unit).

The MCU is built around a host microcontroller (U1) called Coldfire, the working RAM (U4 and U5) and the Flash memory (U6).

Coldfire is controlled by a 40.96 MHz quartz clock.

Note: Configuration of Coldfire upon starting up.

Coldfire starts up as soon as signal PF_RESET/ (hardware reset from the voltage supervisor) appears and generates signal –RST0 (reset generated by Coldfire and used by devices).
While activating -RST0, Coldfire reads entries BUSW0, BUSW1 and WSEL, which are used to set the communication speeds with devices.
Signals WSEL, BUSW0 and BUSW1 are generated by means of U2.

Data bus amplification

The Coldfire data bus undergoes bidirectional amplification by U7.
With the exception of DRAM U4 and U5, all the other devices use amplified data bus B_D(16 - 31).

Signal -WE generated by Coldfire controls the direction of data transmission.
Signal -BD_CS (Buffered Data Chip Select) generated by programmable circuit U10 controls the activation of U7.

Address bus amplification

The Coldfire address bus undergoes unidirectional amplification by means of U3. Only the eight low addresses A(0 - 7) are amplified. With the exception of DRAM U4 and U5, all the other addressed peripherals use amplified address bus BA(0 - 7).

Main clock

A 40.96 MHz quartz oscillator (U9) acts as the main clock (CPU_CLK) of Coldfire.

Generation of intermediate clocks and associated logical functions

A programmable logic circuit (U10) of the GAL22LV10 type is used to generate the secondary clocks and other synchronisation signals from main clock CPU_CLK and asynchronous counter U8.

Secondary clock CLK4M096 is used by the ADPCM audio decoder.

Real time clock

Real time clock U16 is controlled by Coldfire through data bus B_D(16 - 31), address bus BA(0 - 7) and control signals -CS3, -OE and -WE.
It performs the function of real-time clock/calendar and is controlled by 32.768 kHz quartz Q8.

This clock is powered by the backup cell (BT1) when the device is switched off. When the device is running, U16 is powered by VCC = 3.3 V.

Note: software set-up data

The software set-up data of **FRED® Easyport** are saved in the dedicated areas of the Flash memory (U6).

Power supplies, On/Off, pushbuttons and LEDs

Figure ***Diagram 3*** represents the following:

- The various power supplies generated by the CPU board from voltage UBAT (12V lithium cell)
- Voltage monitoring and Coldfire reset signal generation circuits
- On/Off circuits
- On/Off, Analyse and Shock pushbuttons
- Shock and Electrode LEDs

UBAT comes from the defibrillator board and powers the CPU board via the 26-pin flat cable.
The secondary voltages generated are supplied to the defibrillator board by the same flat cable.

Power supplies

Voltage +3.3 VCC

The + 3.3 VCC power supply voltage is derived from the UBAT cell voltage by means of chopping regulator U12, chopping transistors U13A and U13B, diode D4, induction coil L4 and capacitors C113 and C114.
The components make up a step-down regulator. The voltage is controlled by resistor R266.

Voltage +5 V

The +5 V power supply voltage is derived from the cell voltage by means of chopping regulator U11, diode D2, induction coil L3 and capacitors C18, C111 and C116.
The components make up a step-down regulator. The voltage is controlled by dividing bridge R159, R164.

Voltage +5 VOP

The +5 VOP voltage is +5 V filtered by L5, C19 and C112 and is particularly intended to supply power to the operational amplifiers.

Voltage +17.5 V

The +17.5 V power supply voltage is derived from +5 V by means of a step-up chopping regulator made up of U14, L7, D3 C82, C123, R162, R165, R166.

+ 3.3 V power supply voltage supervisor (minimum voltage)

The + 3.3 V power supply voltage supervisor is made up of circuit U18. It provides the RESET_PF pulse when the device is started up and monitors the 3.3 V power supply voltage during operation. A drop below +3 V triggers a Coldfire reset pulse.

U_BAT_SWITCHED, + 3.3V, +5V, +17.5 V voltage supervisor

U17 resets the CPU if any over voltage is seen at the 3.3 V, 5 V or 17.5 V power supplies or if voltage U_BAT_SWITCHED drops below 6.5 V.

Note: During normal operation, the cell voltage is monitored by Coldfire and by the PIC. If there is a fault, an error message is generated and the user is informed if the cell voltage is too low to correctly power **FRED® Easyport.**
The 6.5 V limit is therefore never reached in principle.

On/Off key (S1): Starting up and shutting down

Pressing key S1 polarises the gate of transistor U15 through D11, R201 and R170 so as to make it conduct. (U15 may be considered to be a main switch).
Line UBAT_SWITCHED switches to the cell voltage (U_BAT_FUSED_CPU).

U15 is then kept closed temporarily by Q2 through C84 and D12.

As soon as the Coldfire microcontroller has started, the device is kept operating by pulsed signal CMD_OFF through C86, D12 and Q2.

Signal ON_OFF_KEY is used to see the status of key S1. If it is kept pressed in for a long time, the software ceases to send a signal to CMD_OFF and the device goes off.

The device is shut down by pressing the ON_OFF key for more than 3 seconds.

Analyse key (S2): Starting an ECG analysis

An analysis is started by pressing key S2 when the device is on.
The signal is directly sent to the PIC microcontroller of the defibrillator board.
Coldfire is informed of any press of the key via the serial link from PIC to Coldfire.
Note: The Analyse key may also be read directly by Coldfire via latch U21 (see LCD interface)

Shock key (S3): Delivering a defibrillation shock

The command for giving a defibrillation shock is given by pressing key S3.
Pressing key S3 forces signal CHOC_KEY to zero.
The signal is transmitted directly to the PIC microcontroller of the defibrillator board.
Coldfire is informed of a press on the key via the serial link from PIC to Coldfire.
Note: The Shock key can also be read directly by Coldfire via latch U21 (see LCD interface)

Pressing the Shock key (S3) is only applied when it is lit up by two orange LEDs D15 and D26. The LEDs are switched on by means of transistor Q3 and signal CMD_LED_CHOC generated by Coldfire.

Recognition of type of electrode

The type of electrode used (Child or Adult) is recognised by means of a reed contact REL1. The Child type electrode connector has a permanent magnet that closes contact REL1 and forces signal TYPE_ELECTR to the low logical status. The signal is sent to the microcontroller of the defibrillator.

Note: The connector of the Adult electrode does not have a permanent magnet.

Light emitting diodes (LEDs)

The device has 7 LEDs.

- 4 white LEDs are used to backlight the LCD
- 2 orange LEDs illuminate the Shock button when it is valid (Shock ready)
- 1 LED indicates electrode faults (patient not connected)

Serial links

Figure ***Diagram 4*** represents the three serial links used by **FRED® Easyport**.

- Serial link to an external PC
- Serial link to the defibrillator board
- SPI link to the Mini SD Card memory card

Serial communication with external PC

The serial link (RS232 protocol, TTL levels) through the battery connector (JP5) is used essentially for operations involving upgrades of the device program and set-up. It enables communication between an external PC and Coldfire. It operates at 115.2 kbauds.

A special adapting connector of the size of a battery unit, fitted with a mini DIN connector, is used to set up a physical link between **FRED® Easyport** and the downloading device. Special software (FredCo) is required for using the data from the serial link.

During the set-up and/or download operations, the device must also be powered by means of the connector.

Note: Pin EXT_PWR is connected to U_BAT through the adapter unit.
It enables the software of **FRED® Easyport** to switch automatically to the set-up mode.

Serial communication between Coldfire and the PIC microcontroller of the defibrillator

Serial communication between Coldfire and the PIC microcontroller of the defibrillator takes place through a serial link at 9600 bauds.

Signal TXD_DEFI from the defibrillator microcontroller is directly applied at the input of Coldfire. Signal RXD_DEFI generated by Coldfire is sent to the microcontroller of the defibrillator by means of a voltage level adaptation stage, which is made up of Q1 and Q5.

Serial communication between SPI and the mini SD card interface

The mini SD Card interface is made up of special connector, JP1, designed to accommodate memory cards. During the procedure, the card is used to record the ECG signals and events of the procedure.
The mini SD card is controlled by Coldfire through signals SPI_CS3, QSPICLK, SPI_DATA_IN and SPI_DATA_OUT.

Signals DET_PRESENT_SDCARD and WRITE_PROT_1 are status signals of the memory card, which indicate mini SD card presence and write protection respectively.
The signals are active in the low logical state. The lines linked with JP1 are all protected by 220-Ω resistors. The mini SD card power supply is protected by resistor R253.

LCD display

Figure ***Digram 5*** represents the LCD interface of **FRED® Easyport**.

The LCD display is controlled by Coldfire by means of data bus B_D[24 - 31] and signals -CS1 and -CS4.

Data is written in the LCD registries by means of latch U23 and is controlled by signal LCD_WR generated by latch U22.

Data are read from the LCD registries by means of latch U24 and is controlled by signal LCD_RD generated by latch U22.

The other control signals (LCD_CS, LCD_RS, LCD_RES) are derived from the data bus by means of latch U22.

The power for the logical functions of the LCD screen is provided by the 3.3 V power supply via R143.
A second power source, VLCD, is obtained from the 17.5 V power supply and linear regulator U24.
VLCD is temperature-compensated by thermistor R219, which offers optimum contrast regardless of the ambient temperature.

All the logical links with the LCD screen are filtered by RC networks.

Back lighting is provided by 4 white LEDs controlled by latch U22, through Q4.

Hardware configuration

Some particular options may be put in place by solder spots (LP6 to LP10). The hardware configuration is read by means of input latch U21.
Five entries of the latch are connected to VCC by pull-up resistors R151 to R155 and may be forced to zero.

Input latch U21 is controlled by Coldfire by means of the data bus B_D(24 - 31) and signals -CS1 and -OE via logical door U20A.

Latch D21 also enables direct reading by Coldfire of the status of keys Analyse (S2) and Shock (S3).

Audio functions

Figure ***Diagram 6*** represents the audio interface.

ADPCM decoder

The ADPCM decoder is controlled by Coldfire through data bus B_D[16 - 31] and status control signals -CS2 ; -OE ; -WE ; BA0 ; -RST0 and OKI_FIFO_MID.

The decoder operating frequency is 4.096 MHz. It is achieved by the generation function of the intermediate clocks that is built around U10. The ADPCM decoder (U26) output AOUTL provides an analogue signal is applied to the audio amplification chain formed by U27A, U27B and U28.

Audio amplification

The audio amplifier is built around circuit U28. Pre-filtering is provided by U27B.
The audio signal is applied via a capacitive link (C34) to the power amplifier input, the output of which is applied to the speaker. Power amplifier U28 may be put into standby mode by means of signal POWER_DOWN_AUX/.

Analogue processing and analogue to digital converter

Figure ***Diagram 7*** represents the analogue processing functions and analogue to digital conversion.

The ADC (U36) is controlled by Coldfire by means of data bus B_D[16 - 31], signals -CS5, -WE, -OE, ADC_CSTART and clock CLK4M096.

Line -INT4/EOC informs Coldfire that conversion is completed and that the converted data are available.

The converter resolution is 10 bits and its voltage reference (VREF_2V5) is supplied by D20.

The ADC has eight multiplexed analogue inputs CH0 to CH7, which enable it to digitise the following signals:

CH0: ECG_ADC: Analogue signal from the defibrillator board.
It carries information from the ECG with a bandwidth at -3 dB of 0.5 Hz - 23 Hz. Before it is applied to the input of the ADC, signal ECG_ADC is conditioned by the analogue processing function of the CPU board.

CH1: Z_ELEC_DEFI: Analogue signal from the defibrillator board.
It carries information about patient impedance. Before it is applied to the converter, signal Z_ELEC_DEFI is attenuated by two and filtered by dividing bridge R74, R76 and C48.

CH2: DELTA_Z: Analogue signal generated from Z_ELEC_DEFI by the filter built around U31A. It carries information about impedance variation used for detecting motion.

CH3: CHK_BAT_CPU: Signal used to measure the “instant” battery voltage.

CH4: CHK_BAT_CPU_F: Same signal as CHK_BAT_CPU, only filtered to eliminate the instant variations due to brief current inrushes.

CH5: CHK_BAT_DEF: Signal for controlling the voltage applied to the high-voltage (HV) converter on the defibrillator board, when HV capacitor charging is under way.

CH6: CHK_EXT_PWR: Signal used to determine if the software must start up in AED mode or in set-up mode.
- If pin CHK_EXT_PWR (pin 15 of P2) or pin 2 of battery connector JP5 on the defibrillator board is connected to U_BAT, the device starts up in set-up mode.
- If CHK_EXT_PWR is not connected, which means that a standard battery unit is being used, the device starts in the AED mode.

Note: Link U_BAT to CHK_EXT_PWR is made up of a special “battery” unit designed for downloading.

CH7: (hardware version) The voltage from a divider bridge is applied to input CH7. The value of resistor R81 determines the hardware version of the CPU board.

ECG analogue signals

The defibrillator board provides two signals: ECG_DEFI and ECG_STIM

ECG_DEFI undergoes preliminary filtering on the defibrillator board. It is used to analyse the ECG but cannot be used for extracting pacing pulses.

ECG_STIM is less filtered (for high frequencies) and is used for that purpose.

The operational amplifiers are powered between +5 V and GND, a virtual ground.
V_GND = +2 V is created by U34A.

Analogue processing of signal ECG_DEFI

The continuous component of analogue signal ECG_DEFI undergoes ultimate filtration, amplification and offsetting before it is digitised by the ADC.

Signal ECG_DEFI is applied to analogue switch U29 which is responsible for opening the amplification chain when a pacing pulse is detected. Such opening is controlled by signal INHIB_PACE/.

At the switch output, the signal is applied to follower U30A through a capacitive link made up of R167 and C96, the object of which is to eliminate the continuous component of signal ECG_DEFI. U30B is an inverter (gain = -1) and has no effect on the shape of the signal. The gain is adjusted by R160 and R203 around U34B.
The continuous component is set to 1.25 V by R6 and R7 to be compatible with the input dynamics of the ADC. C47 and C147 adjust the upper cut-off frequency.

Analogue processing of signal ECG_STIM

Pace information is extracted from signal ECG_DEFI by means of the amplification and filtration chain made up of U32A, U32B and U31B.

The output of the amplification and filtration chain is applied to comparators U33A and U33B, which set off the tripping of two monostable triggers U33A and U33B.

At the output of the monostable triggers, D19A, D27A and R146 form an OR gate through which the recognition of a pacing pulse DETECT_PACE/ is sent to Coldfire.

In response, Coldfire sends to line BLOCK_PACE/ a low logical status for a definite time to shape signal INH_PACE/, which is used to open the ECG amplification chain when a pacing pulse is detected.

Signal INH_PACE is also sent to the defibrillator board, where it is also used to open the amplification chain.

Signal INH_PACE_DETECT is used to block pace detection during the self test of the amplification chain.

Processing of other signals

Signals Z_ELEC_DEFI, DELTA_Z, UBAT_SWITCHED, CHK_BAT_DEF and CHK_EXT_PWR are filtered by RC networks before they are applied to the input of the ADC converter.

Electromagnetic compatibility (EMC)

The CPU circuitry is enclosed in a metal housing that is connected at several points to the CAVE chip plan that acts as the reference for EMC filtration.

The CAVE chip plan occupies an outer layer of the CPU PCB and therefore makes up a closed enclosure with the metal housing.

All the CPU input and output signals are filtered by the RC and LC networks.

Description of port modules and labels

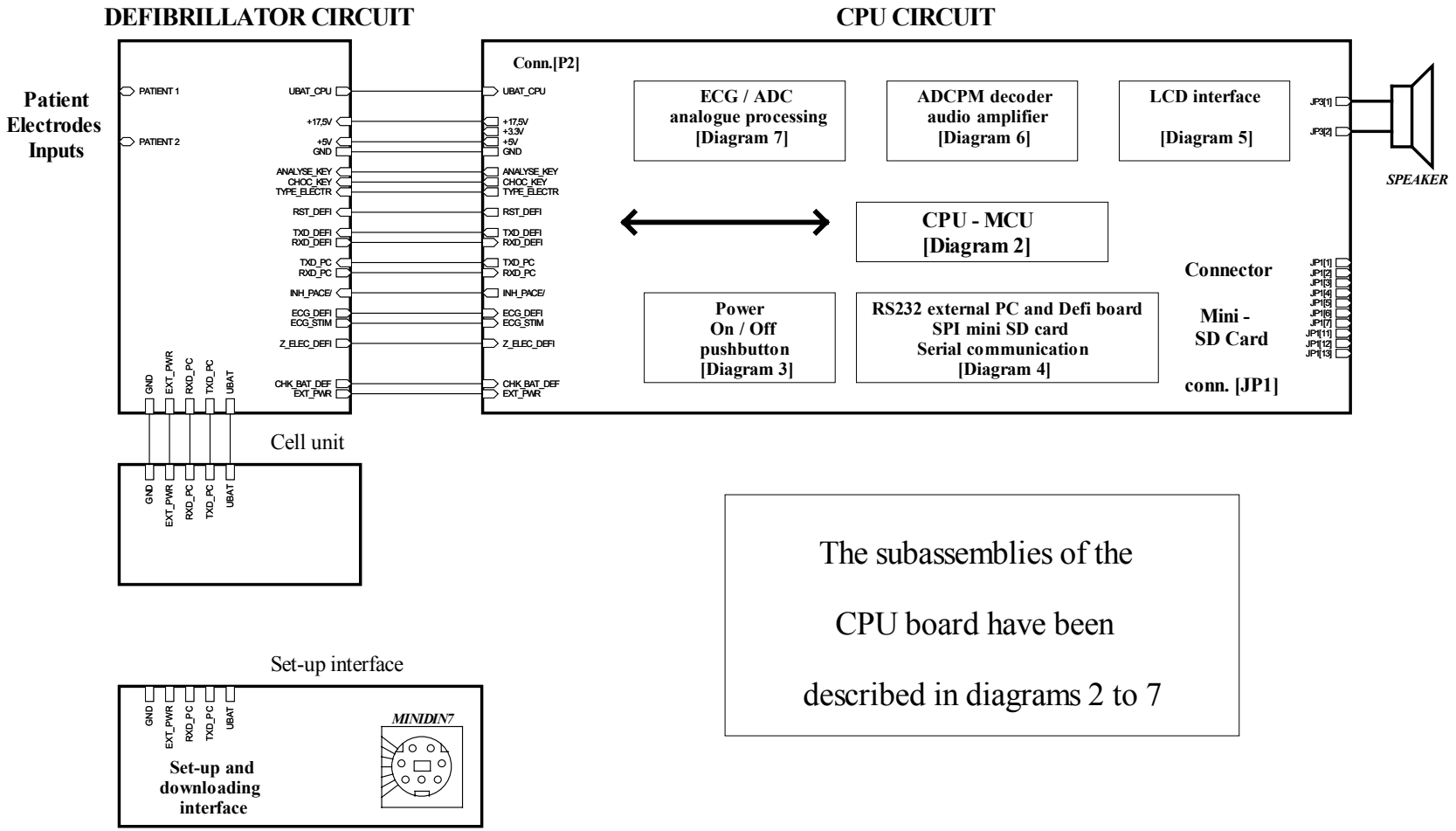
Port module and label	Description
A[0..20]	Coldfire address bus
A10_PRECHG	SDRAM control signal
ADC_CSTART	ADC conversion starting
ANALYSE_KEY	Signal resulting from the activation of the Shock key. Active when low.
BA[0..7]	Amplified address bus
BCLKT	Synchronisation signal
-BD_CS	Data bus buffer command signal
B_D[16..31]	Amplified data bus
BDM_CPU_CLK	Signal of port BDM and JTAG. Not involved in device operation
-BKPT	Signal of port BDM and JTAG. Not involved in device operation
BLOCK_PACE/	Amplification chain analogue switch opening command to remove the pacing pulse Active when low
-BS[0..3]	Control signal of the transfer of data between the SDRAM and Coldfire
-CAS0	SDRAM control signal
CHOC_KEY	Signal resulting from the activation of the Shock key Active when low
CHK_BAT_DEF	Signal from the defibrillator board for measuring the voltage during the charge
CHK_EXT_PWR	Signal for selecting the downloading and set-up mode
CLK4M096	4.096 MHz secondary clock
CPU_CLK	40.96 MHz primary clock
CMD_LED_CHOC	Shock key LED control signal
CMD_LED_ELECTRODE	Adhesive electrode input LED control signal
CMD_OFF	Pulsed signal generated by Coldfire The device is shut down when this signal is absent
-CS[0..7]	Bus made up of different CSs
-CS0	Flash memory addressing (U6)
-CS1	CONFIG and LCD latch addressing (U21 and U22)
-CS2	ADPCM decoder addressing (U26)
-CS3	RTC clock addressing (U16)
-CS4	Addressing of data latches of LCD (U23 and U25)
-CS5	ADC converter addressing (U36)
-CS6	Not used / for future use
-CS7	SDRAM memory addressing (U4 and U5).
D[0..31]	Coldfire data bus.
DDATA[0..3]	Signals of port BDM and JTAG. Not involved in device operation.
DELTA_Z	Analogue signal of the patient impedance measurement used for motion detection
DETECT_PACE/	Pacing pulse detection signal Active when low.
DET_PRESENT_SDCARD	Mini SD card presence detection signal Active when low.

Port module and label	Description
DSCLK	Signal of port BDM and JTAG Not involved in device operation
DSI	Signal of port BDM and JTAG Not involved in device operation
DSO	Signal of port BDM and JTAG Not involved in device operation
-DTEA	Signal of port BDM and JTAG Not involved in device operation
ECG_ADC	ECG analogue signal applied to the ADC input
ECG_DEFI	ECG analogue signal delivered by the defibrillator preamplifier
ECG_STIM	Filtered ECG signal for extracting pacing pulses
-FLASH_BUSY	Flash memory status signal. Active when low.
FST_INHIB	SYNC FST signal inhibition
INH_PACE/	Control signal for opening the analogue switch of the amplification chain while detecting a pacing pulse
INH_PACE_DETECT/	Pacing pulse detection inhibition signal Active when low
-INT4	End of conversion signal indicating that the converted data are available
MTMOD	Configuration signal of port BDM and JTAG. Not involved in device operation
-OE	Signal generated by Coldfire to indicate that data are being read from the data bus
OKI_FIFO_MID	Status signal of ADPCM decoder FIFO
ON_OFF_KEY	Signal resulting from On/Off key activation
PF_RESET/	Reset signal generated by the voltage supervisor. Active when low
POWER_DOWN_AUX/	Audio amplifier standby signal
-PROG ON	Used to force the starting up of the CPU board via connector P2. Not used during normal device operation.
PST[0..3]	Signals of port BDM and JTAG. Not involved in device operation
QSPICLK	SPI serial link clock signal
-RAS0	SDRAM control signal
RST_DEFI	Reset signal generated by Coldfire Applied to the defibrillator microcontroller
REMOTE/	For future extensions. Infrared link
-RST0	Reset signal controlled by Coldfire Active when low
RTC_WATCH_DOG/	Square signal generated by the real time clock and sent to Coldfire
RXD_DEFI	RS232 serial communication between Coldfire and the defibrillator. Signal generated by Coldfire
RXD_PC	Serial link with an external PC (Set-up and downloading) Signal available on the battery connector (JP5 on defibrillator board)
SDBA0	SDRAM address bank control signal
SDCLK	SDRAM bus clock
SDCLKE	SDRAM bus clock control signal
WRITE_PROT_1	Signal indicating that the min SD card is write protected. Active when low.
-SDWE	SDRAM control signal.
SPI_CS3	Address CS3 selection signal of SPI serial link
SPI_DATA_IN	Serial data of the SPI link read by Coldfire
SPI_DATA_OUT	Serial data of the SPI link generated by Coldfire
SYNC_FST	Synchronisation signal
-TEST	Configuration signal of port BDM and JTAG. Not involved in device operation
TYPE_ELECTR	Recognition of Child/Adult electrode type
TXD_DEFI	RS232 serial communication between Coldfire and the defibrillator. Signal generated by the defibrillator microcontroller.

Port module and label	Description
TXD_PC	Serial link with external PC (set-up and downloading) Signal available on the battery connector.
UBAT UBAT_FUSED_CPU UBAT_SWITCHED	Device power supply voltage (on connector P2). Power supply voltage after the protective fuse. Switched power supply voltage.
VREF_2V5	+2.5 V reference voltage
-WE	Signal generated by Coldfire to indicate that data are being written to the data bus.
Z_ELEC_DEFI	Signal representative of patient impedance.
+17,5 V +3,3 V +5 V +5 VOP	+17.5 V auxiliary voltage Used to command the IGBTs on the defibrillator board and the LCD. +3.3 V auxiliary power supply voltage. Mainly used by the digital part of the CPU PCB. Auxiliary +5 V power supply voltage. Power supply of the analogue part of the CPU and defibrillator. Filtered +5 V power supply voltage

Diagram 1

General diagram

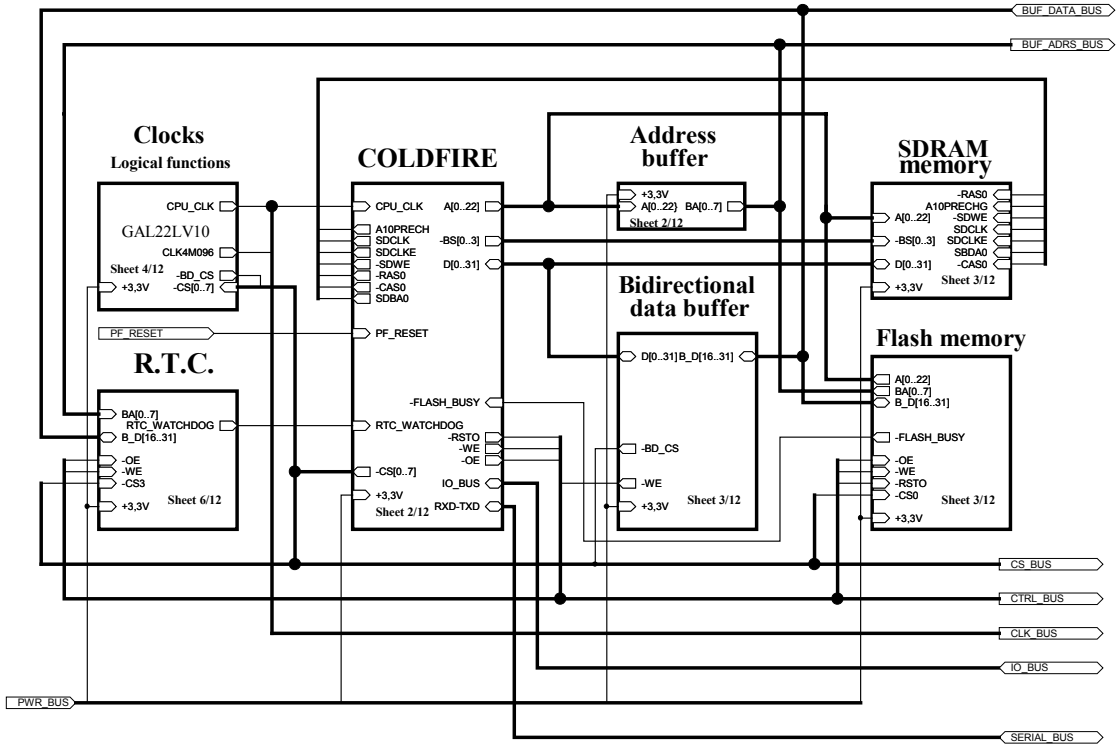


CPU - FRED EASY PORT - General diagram		Schema No. :	SCHILLER MEDICAL S.A.S. 4, rue Louis Pasteur ZAE Sud BP50 67162 WISSEMBOURG CEDEX
Project :	PCB No.:	Date:	
Size: A3 Drawn by :	Art. No. :	Sheet 1 of 7	

Diagram 2

CPU - MCU

ColdFire - Memory - Clocks



Buffered data bus

Buffered address bus

CS (Chip Select) bus

Control bus (WR, OE, RSTO)

Clocks

Miscellaneous in/outputs

RS232 serial links

CPU - FRED EASY PORT - CPU - MCU		Schema No. :	SCHILLER MEDICAL S.A.S. 4, rue Louis Pasteur ZAE Sud BP50 67162 WISSEMBOURG CEDEX
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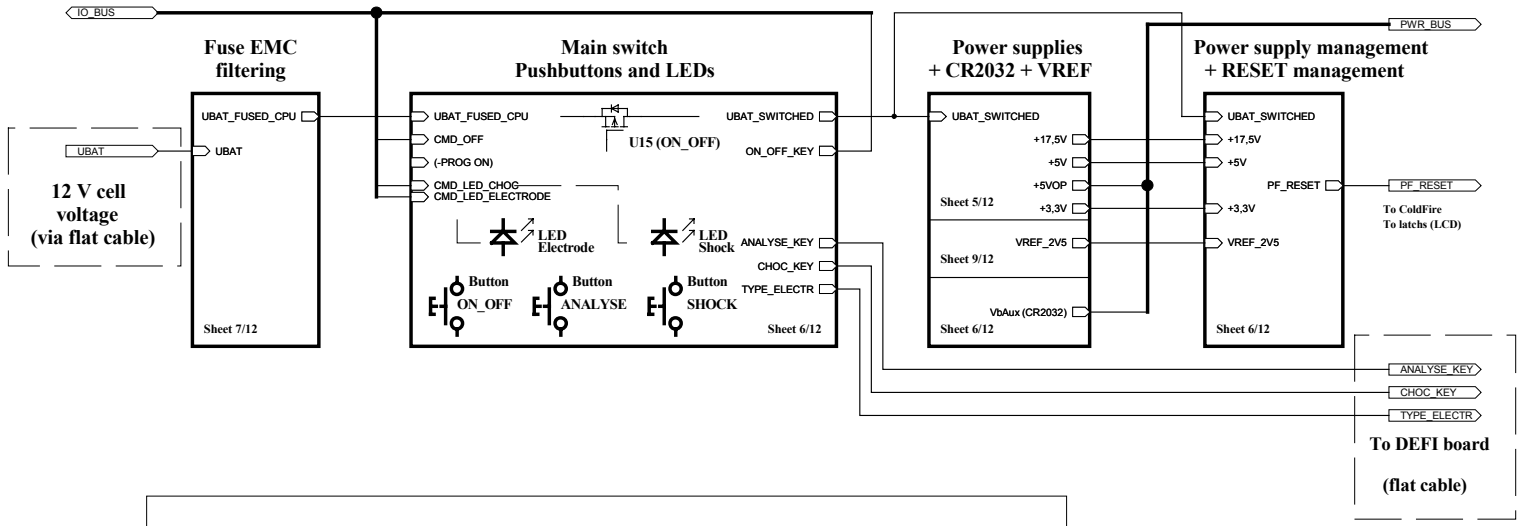
Size: *A3* Drawn by :	Art. No. :	Sheet *2* of *7*	

Diagram 3

On/Off - Power supplies- Pushbuttons - LEDs



[PWR_BUS]> contains the following power supplies :

+3,3 V **ColdFire and device power supply (= Vcc)**
+5 V **Audio amplifier power supply**
+5 VOP **Filtered power supply for operational amplifiers**
+17,5 V **Power supply used on Defi board (IGBTs and HV converter control)**

VbAux **Power supply to the real clock when the device is off**

VREF_2V5 **Voltage reference used by the ADC converter (36)**

CPU - FRED EASY PORT - Power supplies - PBs		Schema No. : *WSM0005_SYN3*	SCHILLER MEDICAL S.A.S. 4, rue Louis Pasteur ZAE Sud BP50 67162 WISSEMBOURG CEDEX
Project :	PCB No.:	Date:	
Size: *A3* Drawn by :	Art. No. :	Sheet *3* of *7*	

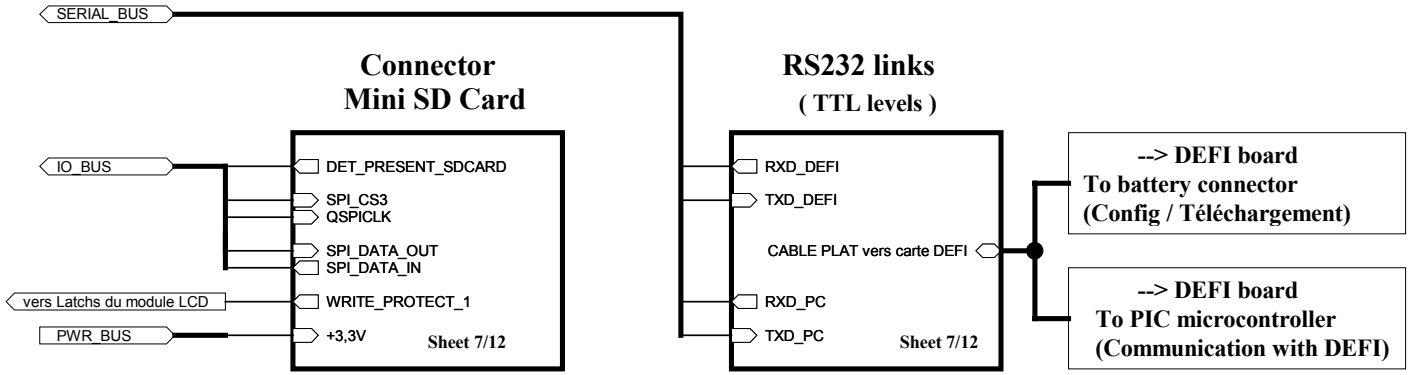
Diagram 4

Serial communication

ColdFire <-> SPI Mini SD Card

ColdFire <-> Defibrillator board

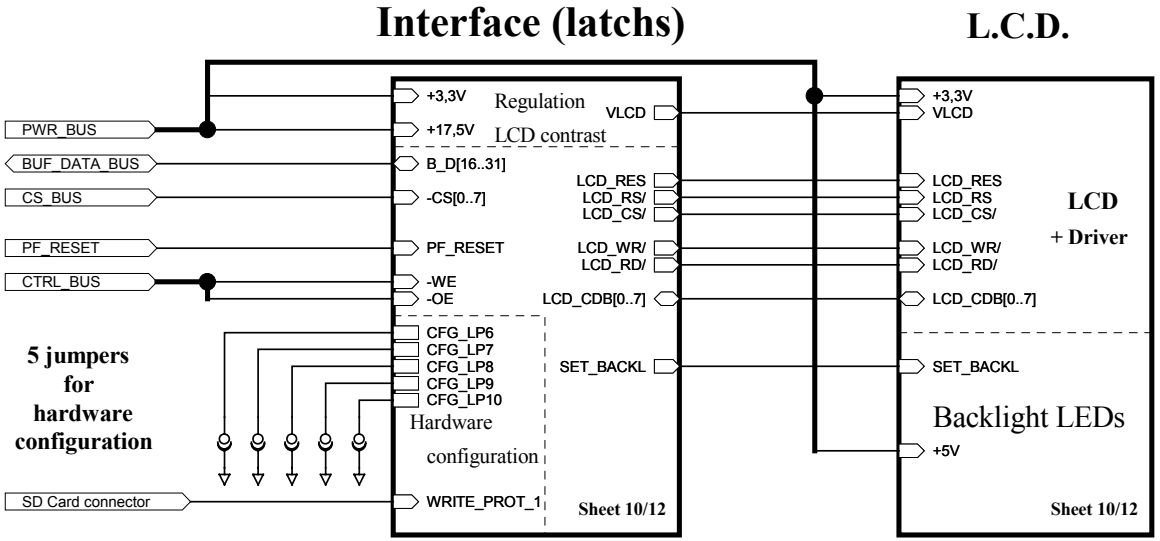
ColdFire <-> External PC (set-up)



CPU - FRED EASY PORT - Serial links		Schema No. :	**SCHILLER** MEDICAL S.A.S. 4, rue Louis Pasteur ZAE Sud BP50 67162 WISSEMBOURG CEDEX
Project :	PCB No.:	Date:	
Size: *A4* Drawn by :	Art. No. :	Sheet *4* of *7*	

Diagram 5

LCD interfaceand hardware configuration



CPU - FRED EASY PORT - LCD Interface			Schema No. :
Project :		PCB No.:	Date:
Size: *A4*	Drawn by :	Art. No. :	Sheet *5* of *7*

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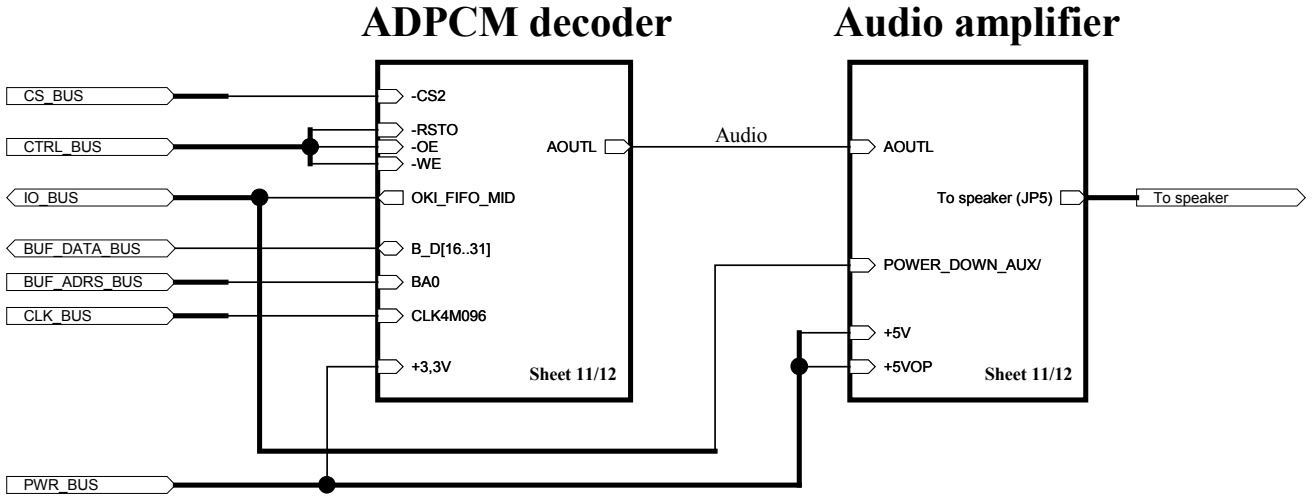
Diagram 6

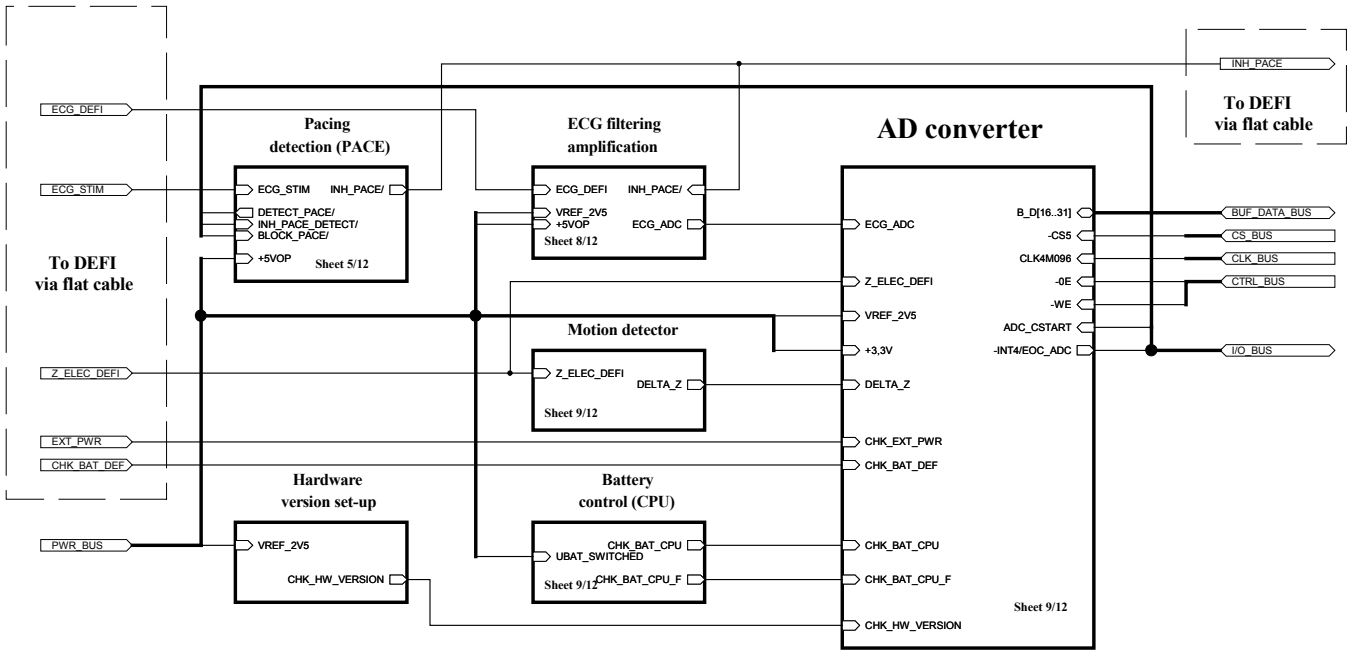
ADPCM decoding - Audio amplification



CPU - FRED EASY PORT - Audio amplification			Schema No. :	**SCHILLER** MEDICAL S.A.S. 4, rue Louis Pasteur ZAE Sud BP50 67162 WISSEMBOURG CEDEX
Project :		PCB No.:	Date:	
Size: *A4*	Drawn by :	Art. No. :	Sheet *6* of *7*	

Diagram 7

Analogue ECG processing - AD conversion



CPU - FRED EASY PORT - Analogical - ADC			Schema No. :
Project :		PCB No.:	Date:
Size: *A3*	Drawn by :	Art. No. :	Sheet 7 of 7

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5.3 Defibrillator board, part no. 3.2628

The lower part of FRED Easyport contains the housing for the Lithium MnO_2 cell and the defibrillator PCB.

The defibrillator PCB (part no. WSM0040_PCB) includes the following parts:

- **ECG preamplifier**

The ECG preamplifier acquires the ECG signal collected through the adhesive defibrillation electrodes.

- **Defibrillator control circuit**

The defibrillator control circuit is responsible for controlling the charge of the HV capacitor and the defibrillation shock.

- **High-voltage circuit and HV capacitor**

The high-voltage circuit charges and discharges the HV capacitor and measures the charging voltage and the patient current during the defibrillation shock.

- **IGBT control circuit**

The IGBT control circuit controls the IGBT transistors of the high-voltage unit in order to generate a patient impedance compensated pulsed biphasic waveform.

5.3.1 OPERATING OF THE DEFIBRILLATOR SECTION

GENERAL DESCRIPTION

The defibrillator circuit has four connectors:

- one connector (2 high-voltage contacts) for connecting the adhesive electrodes
- one connector (5 contacts) for connection with the lithium cell
- one connector (26 contacts) for connection with the CPU board
- one connector (5 contacts) for programming the µC of the defibrillator circuit

The power circuit of the defibrillator part that is used to charge the HV capacitor is directly powered by the lithium cell protected by a fuse (voltage U_BAT_F_DEFI). The defibrillator control circuits and the ECG preamplifier part are powered by +5 V voltage generated on the CPU board. The IGBT control circuit is also powered by the +5 V voltage and by 17.5 V generated on the CPU board.
The voltage references used by the defibrillator part are generated locally in the defibrillator circuit.

The defibrillator function of FRED Easyport is a sequential circuit with six distinct phases:

1) Standby phase: phase during which FRED Easyport is powered and the defibrillator part is standing by (no request for a charge).

2) Charge phase: phase during which the HV generator charges the HV capacitor (45 µF / 2.4KV). The charge phase may be initiated by two distinct commands:
   - Preliminary charge command
   - Charge command

3) Preliminary charge completed: phase that follows the preliminary charge command, when the selected energy value is reached. During this phase, the defibrillation shock is blocked.

4) Hold phase: phase that follows a Charge command when the selected energy is reached. This phase lasts at least 20 seconds, during which time the HV capacitor remains charged. FRED Easyport is ready to give a defibrillation shock.

5) Shock phase: this is the phase during which FRED Easyport gives the patient impedance compensated pulsed biphasic defibrillation shock.

6) Safety discharge: this is the phase during which the energy stored in the HV capacitor is discharged into a circuit internal to FRED Easyport.

ECG PREAMPLIFIER

The preamplifier part performs the following functions:

- ECG signal acquisition
- ECG signal amplification and processing
- Acquisition circuit verification
- Patient impedance measurement

GENERAL DESCRIPTION:

On the defibrillator PCB, the ECG preamplifier is located close to RV1 under the upper metal shielding. The ECG preamplifier part amplifies the ECG signal and measures the patient impedance. The patient's ECG signal is collected through the adhesive defibrillation electrodes. The amplified ECG signal is transmitted in analogue form to the CPU board. The ECG preamplifier board supplies two ECG signals, signal ECG_DEFI designed for analysing and recognising fibrillation and signal ECG_STIM that is used to detect any pacing pulses. The ECG signals are analysed and interpreted on the CPU board.

If pacing pulses are detected, the CPU board directly controls the ECG acquisition circuit of the ECG preamplifier (signal INH_PACE). The ECG signal acquisition circuit test is controlled by the µC of the defibrillator circuit (30 kHz signal), which injects a square signal with a 10-Hz frequency for 2 seconds into the 30-kHz signal when FRED Easyport is switched on. That 10-Hz signal is used to check the operating of the ECG signal acquisition circuit by the CPU board.

The ECG preamplifier part also measures patient impedance through the 30-kHz square signal. After treatment, the signal corresponding to the value of the patient impedance is transmitted to the CPU board in analogue form (signal Z_ELEC_DEFI). The signal is also used by the defibrillator control circuit to permit the defibrillation shock only if the defibrillation electrodes are stuck correctly (signal Z_ERROR).

DEFIBRILLATOR CONTROL CIRCUIT

The defibrillator control circuit performs the following functions:

- Defibrillator section self test
- Transfer of data by serial link to the CPU board
- HV capacitor charge control
- Measurement of the energy stored by the HV capacitor
- Triggering of the defibrillation shock if the shock key is pressed
- Control of the IGBT module to generate the patient impedance compensated pulse biphasic waveform
- Determination of patient resistance during the defibrillation shock
- Safety discharge of the HV capacitor

GENERAL DESCRIPTION:

The defibrillator control circuit contains a microcontroller that performs all the functions described above. When the device is powered up, the defibrillator control circuit runs a self test of the defibrillator section. The defibrillator control circuit microcontroller transmits the data to the CPU board by means of a serial link. During the AED protocol, the defibrillator control circuit microcontroller checks if the Analyse key is pressed (signal ANALYSE_KEY) and transmits the corresponding information through the serial link to the CPU board. If VF/VT is recognised by the master microprocessor of the CPU board, it sends a request for a preliminary charge and the selected energy value via the serial link. Before triggering the HV capacitor charge, the defibrillator control circuit microcontroller checks the operating of the Charge transistor through signal CHK_BAT_DEF. When the test is completed, the defibrillator control circuit generates the activation signal of the Charge transistor (signal On_OFF_CONV). The IGBT responsible for the safety discharge (S6, module IGBT) is activated continuously by signal DECH_INT. The microcontroller validates the oscillator powering command by means of signal STOP_CHARGE. When the different operations are performed, the HV capacitor charge is triggered by a pulse (signal START_CHARGE) and the HV generator starts oscillating to self power the HV generator. While the HV capacitor is being charged, the microcontroller measures the energy stored in the HV capacitor by means of signal V_HV1. While the HV capacitor is being charged, IGBT S1 is blocked and S6 conducts (making it possible to reference the potential of the upper branch of bridge H to the ground, in order to ensure that the ECG signal collected by the adhesive defibrillation electrodes is stable). When the

stored energy is equal to the selected energy, the microcontroller stops the HV generator (signal STOP_CHARGE) and the defibrillator circuit switches to the preliminary charge completed stage, where the defibrillation shock is blocked. During the preliminary charge completed phase, the microcontroller measures the energy stored in the HV capacitor by means of signal V_HV2. If, during the previous charging phase, the ECG signal analysed by the CPU board confirms VF/VT, the CPU board sends a new charge request, to the defibrillator circuit this time. The defibrillator control circuit activates the HT generator (signals ON_OFF_CONV and START_CHARGE) till the new selected energy is reached. When the energy stored in the HV capacitor is equal to the energy selected, the microcontroller stops the HV generator (signal STOP_CHARGE) and authorises the defibrillation shock. The defibrillator is in the hold phase, during which the stored energy is measured by signal V_HV2. During the hold phase, which may last 20 seconds at the most, pressing the Shock key (signal CHOC_KEY) directly interconnected to the defibrillator circuit triggers the defibrillation shock by means of two different signals. The first shock delivery signal is made up of the signal directly from the Shock key (signal SHOCK_EN1). The second defibrillation shock triggering signal is signal SHOCK_EN2 generated by the defibrillator control circuit microcontroller when the Shock key is pressed. The signal duration is approximately 12 ms. The two signals above are used to validate the control signals of the IGBT module for the two phases of the defibrillation shock. When a press on the Shock key is taken into account, the microcontroller generates the first shock pulse after a 40-ms delay (in order to ensure that IGBT S1 is conducting and S6 is correctly blocked). During the first pulse, the microcontroller measures the defibrillation current by means of signal V_IPAT in order to determine the patient impedance. When the patient impedance has been determined, the microcontroller generates the waveform with a cyclical ratio adapted to the patient impedance, by means of signals PH1_EN, PH1, PH2_EN and PH2. When the pulsed biphasic defibrillation pulse is generated, the microcontroller blocks IGBT S1 and makes S6 conduct; **the energy remaining in the HV capacitor is not dissipated in the safety discharge circuit after the shock.** During a defibrillation shock, the microcontroller calculates the energy delivered and transmits that value and the peak current and patient impedance to the CPU board.

HIGH VOLTAGE CIRCUIT

The high-voltage circuit part performs the following functions:

- Patient insulation from the high-voltage circuit
- Charging the HV capacitor to the set energy
- Measurement of the HV capacitor charge voltage
- Generation of the patient impedance compensated pulsed biphasic waveform
- Measurement of the peak value of the defibrillation current
- HV capacitor safety discharge

GENERAL DESCRIPTION:

The high voltage circuit insulates the patient from the high-voltage unit of the defibrillator by means of IGBT S1 of the IGBT module. The defibrillator charge circuit is directly powered by the lithium cell via the Charge transistor (signal ON_OFF_CONV). The HV capacitor is charged by the HV generator (signal START_CHARGE). When the HV capacitor is being charged, IGBT S1 (patient insulation) is blocked and IGBT S6 (safety discharge) is saturated. During the HV capacitor charge, the HV capacitor charge voltage is measured by a voltage divider that supplies signal V_HV1. The signal is used by the defibrillator control circuit to determine the energy stored in the HV capacitor. When the energy stored in the HV capacitor is equal to the energy defined by the CPU board, the HV generator is disabled, which stops the charge - signal STOP_CHARGE. When the defibrillator is in the hold phase, the charge voltage is measured by a second voltage divider at the terminals of the HV capacitor (signal V_HV2). During the charge and hold phases, the high-voltage circuit continues to insulate the patient by blocking S1 and making S6 conduct. IGBT S1 is blocked by an optocoupler (U21) and a photovoltaic cell (OPT1) controlled by signals IGBT_OFF and GENERAL_EN generated by the microcontroller.

When the Shock key is pressed, the defibrillator control circuit generates signal SHOCK_EN2, which in association with SHOCK_EN1 validates the defibrillation shock. When the defibrillation shock is initiated, the microcontroller generates two signals PHASE1_EN and PHASE2_EN that validate phases 1 and 2 respectively of the defibrillation shock. The two signals continuously activate the two upper IGBTs (S2 and S3) of the bridge H throughout the duration of each respective phase by means of two photovoltaic cells (OPT2 and OPT3). The pulsed biphasic waveform is chopped or generated by the pulse trains of signals PHASE1_DECOUP and PHASE2_DECOUP which control the IGBTs (S4 and S5) of the bridge H, which are referenced to the ground. With the first defibrillation waveform

current pulse, the high-voltage circuit measures the value of the patient current (signal V_IPAT). This information is used by the microcontroller to determine the patient impedance in order to control the IGBT control circuit. All the control signals required to generate the pulsed biphasic waveform are directly supplied by the microcontroller, which adapts the cyclical ratio of the pulses to the patient impedance. The high-voltage circuit is also used for the safety discharge of the HV capacitor by means of the IGBT module (IGBTs S1 and S6) and a power resistor. The safety discharge is only possible when S1 and S6 conduct simultaneously. The IGBTs are controlled by the microcontroller. The safety discharge may be initiated either directly by the defibrillator circuit microcontroller or by a signal sent via the serial link by the CPU board.

IGBT CONTROL CIRCUIT

The IGBT control circuit performs the following functions:
- Blocking the IGBTs during the charge and hold phases (S6 conducts).
- Commanding the IGBTs to generate the patient impedance compensated pulsed biphasic waveform during the defibrillation shock.

GENERAL DESCRIPTION:
The IGBT control circuit blocks the IGBTs (S1, S2, S3, S4 and S5) of the module and makes IGBT S6 conduct during the charge, preliminary charge completed and hold phases in order to insulate the patient. The gates of the IGBTS of the high voltage unit that are not referenced to the ground (S1, S2 and S3) are controlled by an optocoupler and photovoltaic cells. The IGBTs are controlled by signals IGBT_OFF, GENERAL_EN, PHASE1_EN and PHASE2_EN. During the defibrillation shock phase, the microcontroller directly generates the signals required to control the pulsed biphasic waveform when the shock validation circuit is activated by signals SHOCK_EN1 and SCHOCK-EN2. Before activating the IGBTs of bridge H, the microcontroller blocks IGBT S6 and makes S1 conduct. During the defibrillation shock, the microcontroller controls the IGBTs to generate the patient impedance compensated pulsed biphasic waveform. First of all (after S1 closes), IGBT S2 is activated continuously by signal PHASE1_EN. After a small delay, IGBT S5 is controlled by signal PHASE1_DECOUP as regards the pulses of phase1. During the first pulse, the microcontroller determines the patient impedance and on the basis of the impedance, applies a constant cyclical ratio to the chopping signal. After a set time following the first phase, IGBT S3 starts conducting continuously (signal PHASE2_EN), and then IGBT S4 is controlled by signal PHASE2_DECOUP, which leads to the pulses of phase 2. After the defibrillation shock, IGBT S1 is blocked when S6 is saturated and the **energy remaining after the shock remains stored in the HV capacitor.**

FAULT DETECTION

GENERAL DESCRIPTION:
In order to detect any critical fault conditions due to technical faults, different circuits are monitored by the microcontroller.

When the FRED Easyport device is powered up, the microcontroller runs a self test during which the specific operating of the µC is checked by mean of the following tests:
- watchdog operating test
- internal memory test
- ADC test
- Shock button test

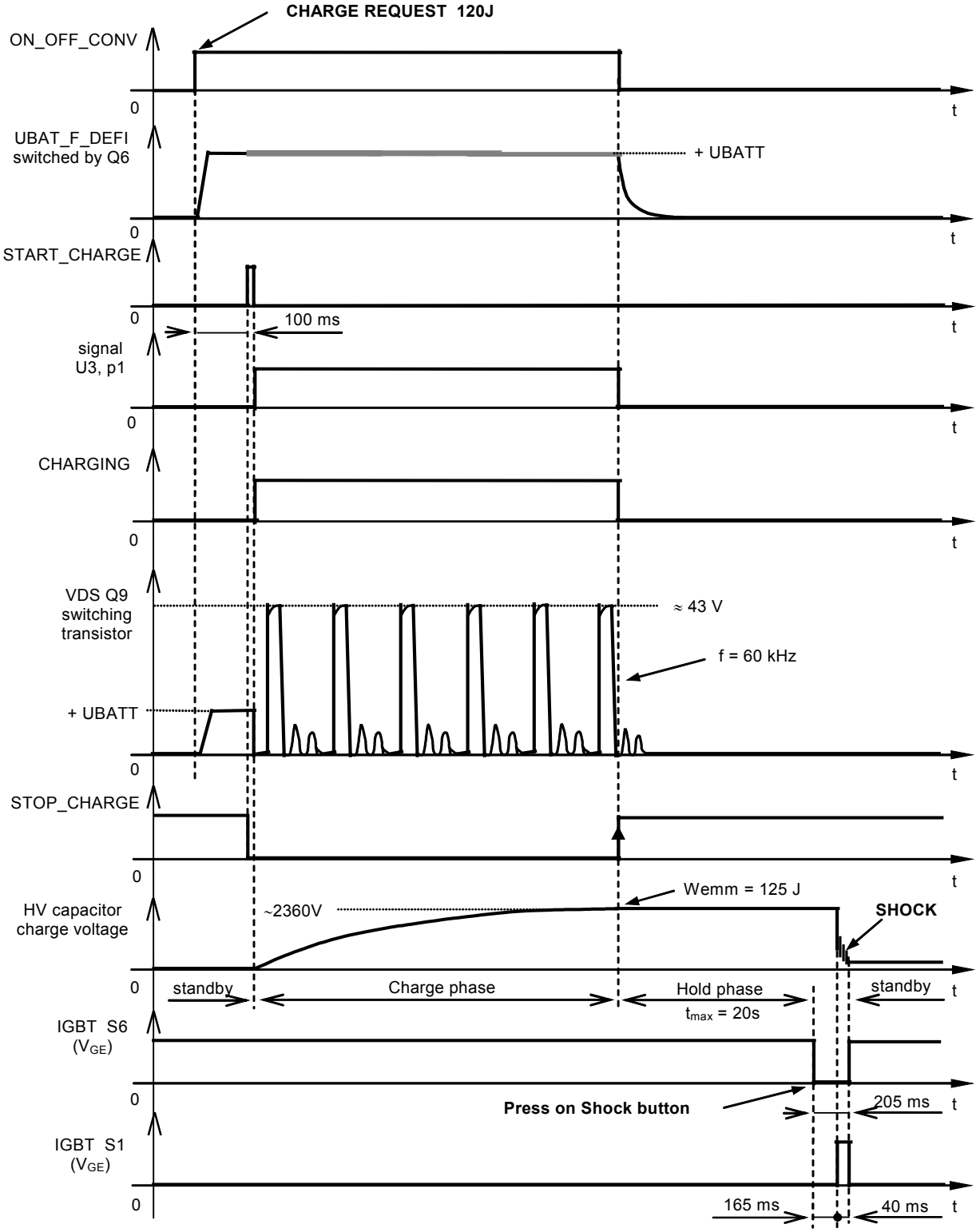
Besides, when the defibrillator part is operating, the microcontroller monitors the fault conditions below:
- test of the operating of the Charge transistor when the charge is triggered
- test of the operating of the HV generator during the charge
- test of the operating of IGBT S1 during the charge
- test of the operating of IGBTs S2 or S3 during the shock
- test of the operating of IGBTs S4 or S5 during the shock
- safety discharge time greater than 15s

Besides, the defibrillator circuit also includes a hardware circuit designed to detect off-range HV capacitor charging voltage.

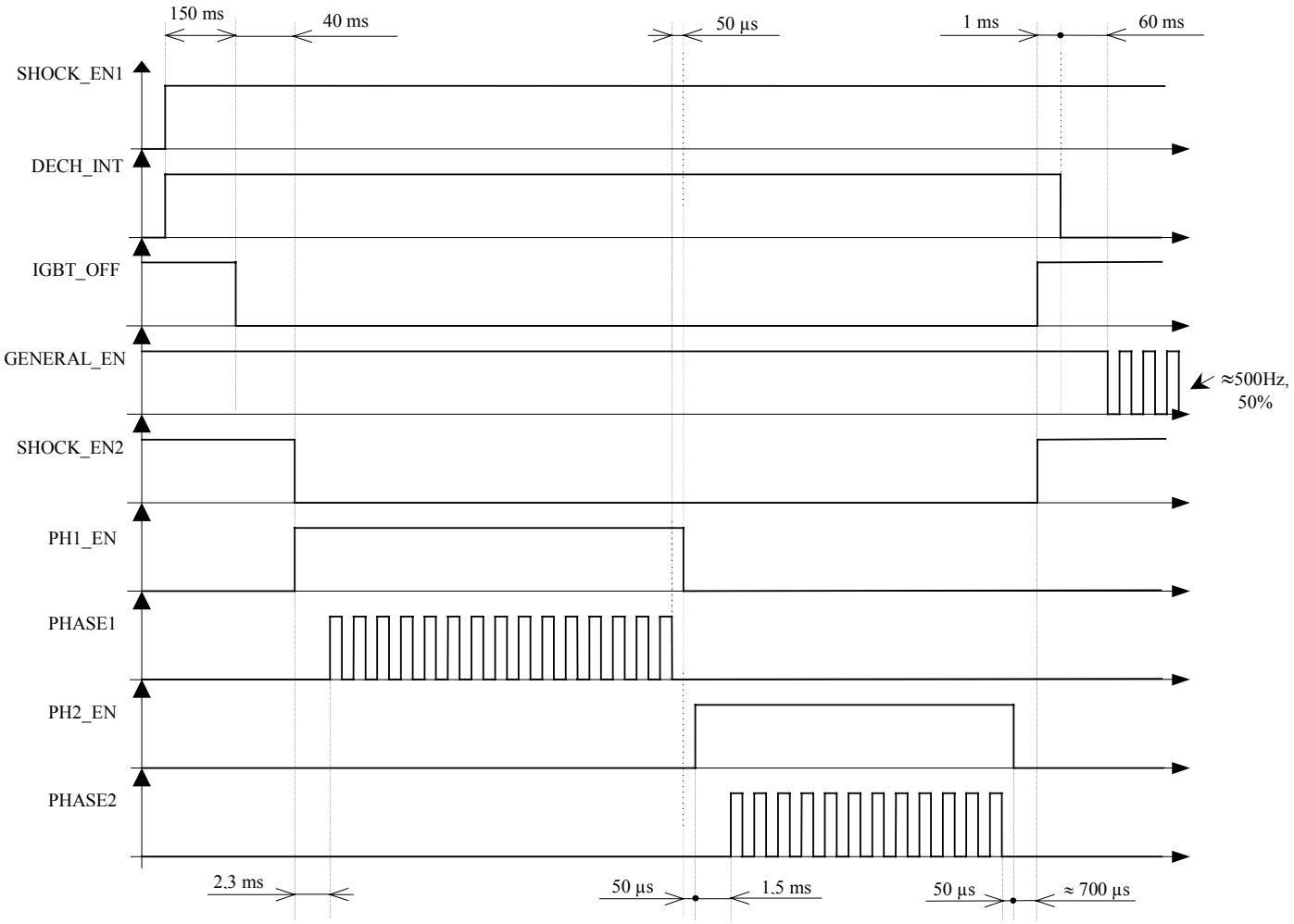
The different fault conditions above are all detected by the microcontroller, which then disables all the outputs, runs a safety discharge and transmits an error message to the CPU board.

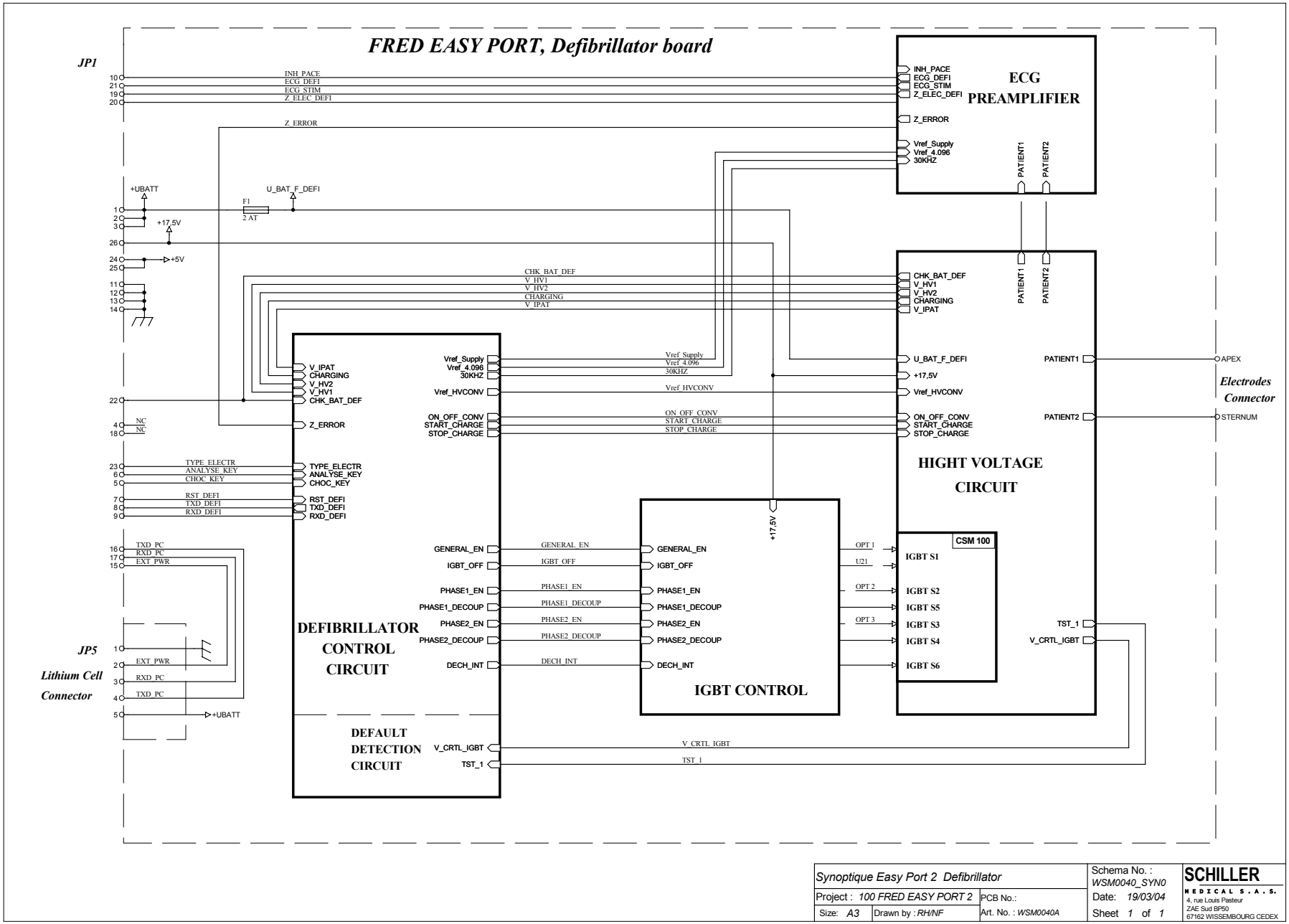
5.3.2 TIME CHARTS

HV CAPACITOR CHARGE

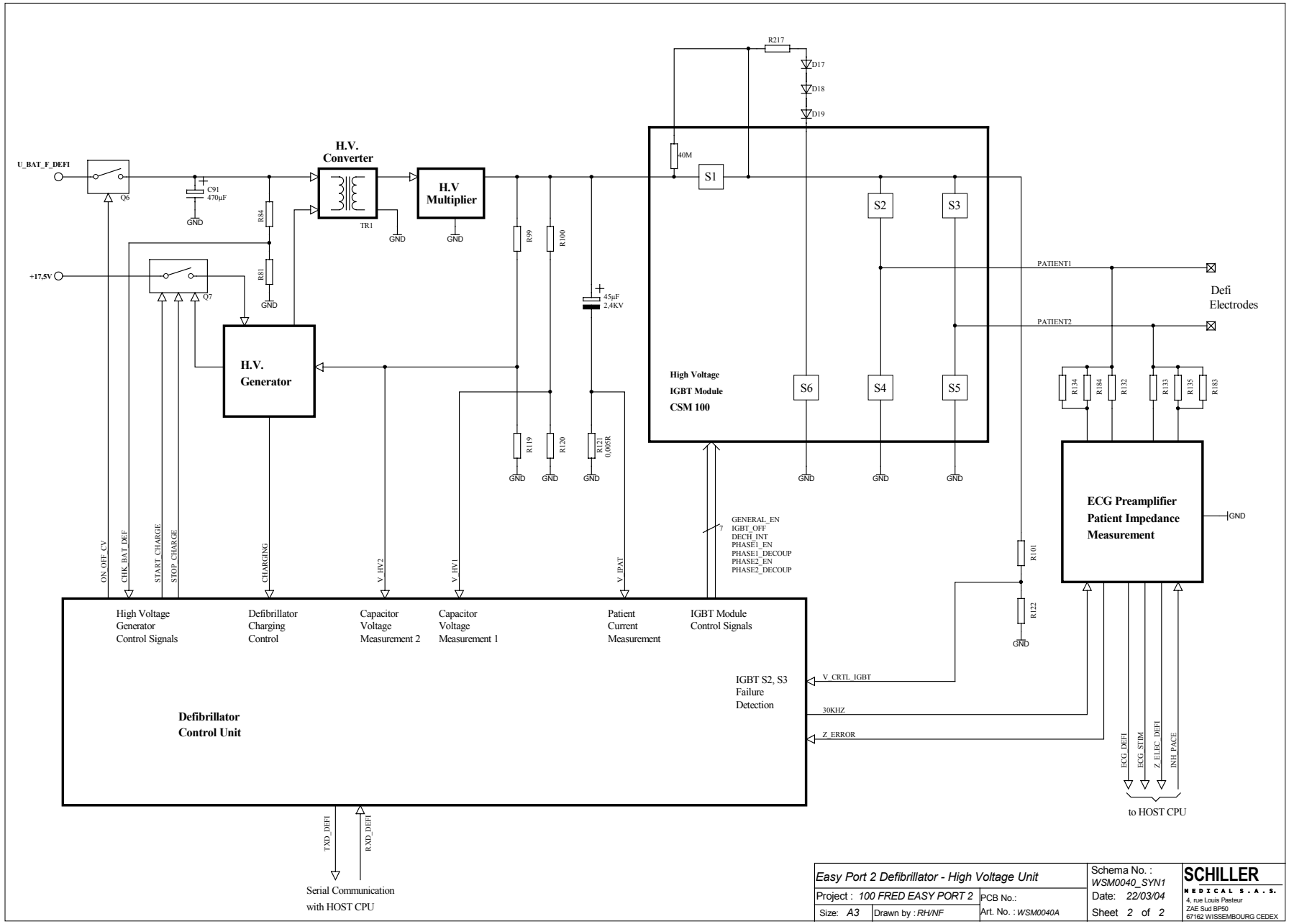


DEFIBRILLATION SHOCK





Synoptique Easy Port 2 Defibrillator		Schema No. : WSM0040_SYN0	SCHILLER MEDICAL S.A.S. 4, rue Louis Pasteur ZAE Sud BP60 67162 WISSEMBOURG CEDEX
Project : 100 FRED EASY PORT 2	PCB No.:	Date: 19/03/04	
Size: A3	Drawn by : RH/NF	Art. No. : WSM0040A	Sheet 1 of 1


U_BAT_F_DEFI
Q6
C91
470µF
GND
R84
R81
+17,5V
Q7
H.V.
Converter
TR1
H.V
Multiplier
R217
D17
D18
D19
40M
S1
S2
S3
S4
S5
S6
High Voltage
IGBT Module
CSM 100
PATIENT1
PATIENT2
Defi
Electrodes
R99
R100
45µF
2,4KV
H.V.
Generator
R119
R120
R121
0,005R
R134
R184
R132
R133
R135
R183
ECG Preamplifier
Patient Impedance
Measurement
R101
R122
ON OFF CV
CHK BAT DEF
START CHARGE
STOP CHARGE
CHARGING
V_HV2
V_HV1
V_IPAT
GENERAL_EN
IGBT_OFF
DECH_INT
PHASE1_EN
PHASE1_DECOUP
PHASE2_EN
PHASE2_DECOUP
High Voltage
Generator
Control Signals
Defibrillator
Charging
Control
Capacitor
Voltage
Measurement 2
Capacitor
Voltage
Measurement 1
Patient
Current
Measurement
IGBT Module
Control Signals
IGBT S2, S3
Failure
Detection
V_CRTL_IGBT
30KHZ
Z_ERROR
ECG_DEFI
ECG_STIM
Z_ELEC_DEFI
INH_PACE
to HOST CPU
Defibrillator
Control Unit
TXD_DEFI
RXD_DEFI
Serial Communication
with HOST CPU
Easy Port 2 Defibrillator - High Voltage Unit
Project : 100 FRED EASY PORT 2
PCB No.:
Size: A3
Drawn by : RH/NF
Art. No. : WSM0040A
Schema No. :
WSM0040_SYN1
Date: 22/03/04
Sheet 2 of 2
SCHILLER
MEDICAL S.A.S.
4, rue Louis Pasteur
ZAE Sud BP50
67162 WISSEMBOURG CEDEX

6. Device modifications

6.1 Definition

ECL:

The ECL is the two-digit revision number (PN) of the card

- P : Card version number, which is incremented every time the card is rerouted.
- N : Incremented with each modification on the card. N is reset to A when the P version changes.

HARDWARE VERSION:

Digit incremented with each card change, which may be recognised by the software, as an electronic system present on the cards makes it possible to adjust a resistor and define a voltage limit that is converted by the device into a hardware version. There are 46 card possibilities (1 - 46).
On the CPU board, resistor R81 must be adjusted.
On the defibrillator board, resistor R163 must be adjusted.

6.2 CPU circuit

Part no.	ECL	Modifications	Hardware
3.2627	CA	First manufactured card version	Version: 1 R81 = 3.3 M

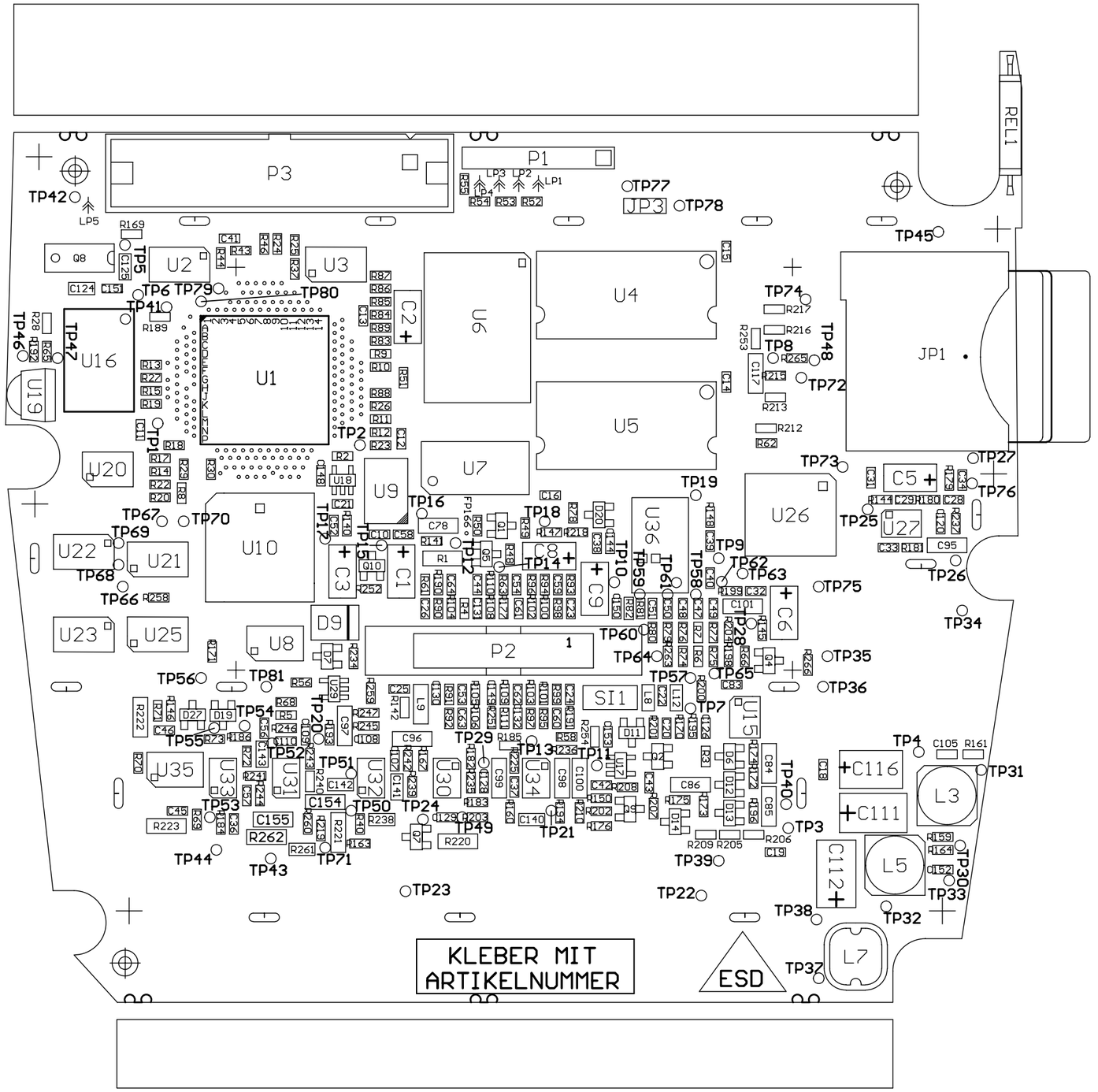
6.3 Defibrillator circuit

Part no.	ECL	Modifications	Hardware
3.2628	BA	First manufactured card version	Version: 1 R164 = 3.3 M

7. Layout drawings

7.1 CPU circuit 3.2627

D2627CA



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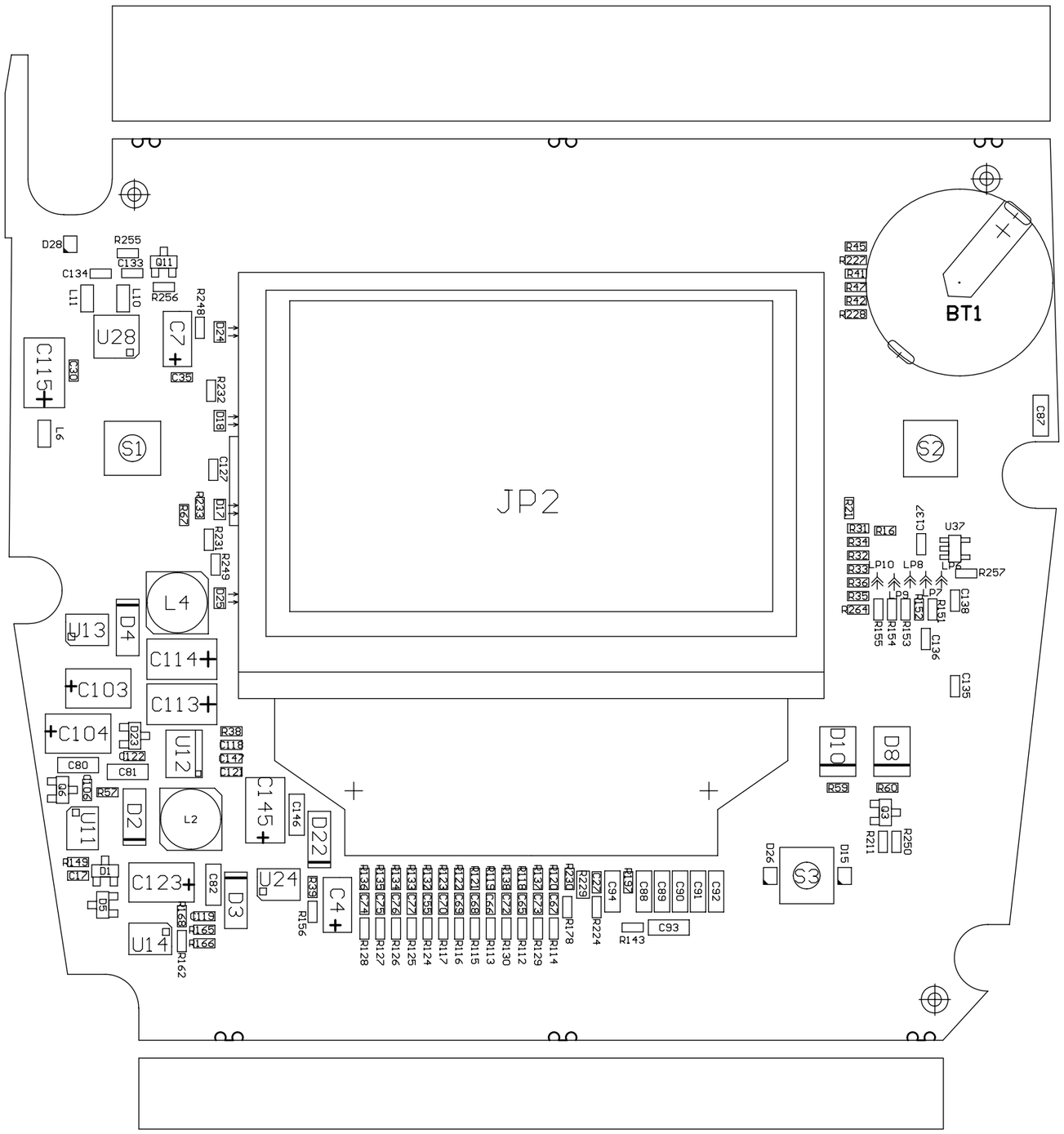
Project: EASY PORT					
Visum:	Drawn By: Gau	Entw.	Prod.	Date 23.02.04 Sheet 1 of 2	



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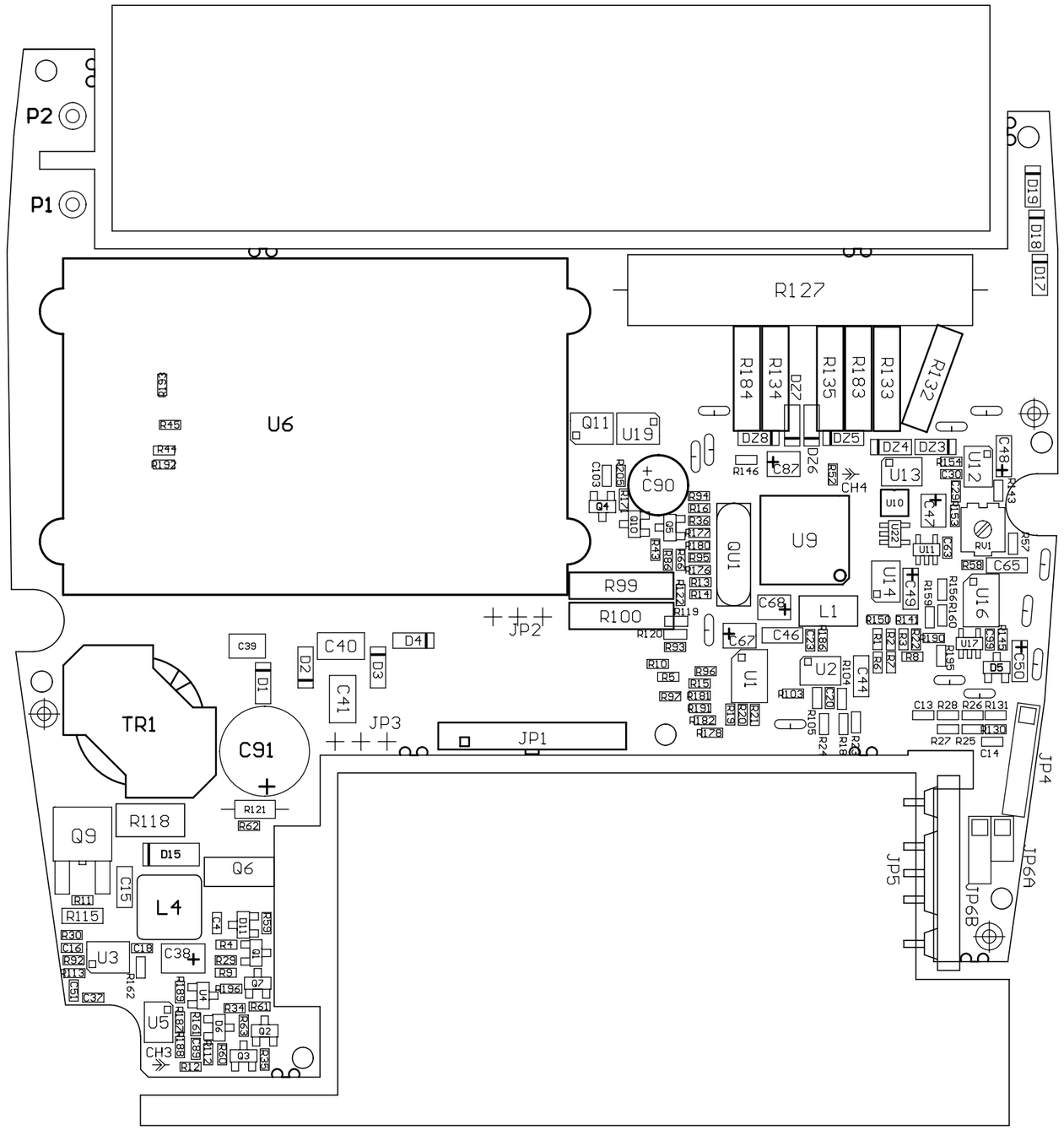
Project: EASY PORT					
Visum:	Drawn By: Gau	Entw.	Prod.	Date 23.02.04 Sheet 2 of 2	

7.2 Defibrillator circuit 3.2628

D2628BA



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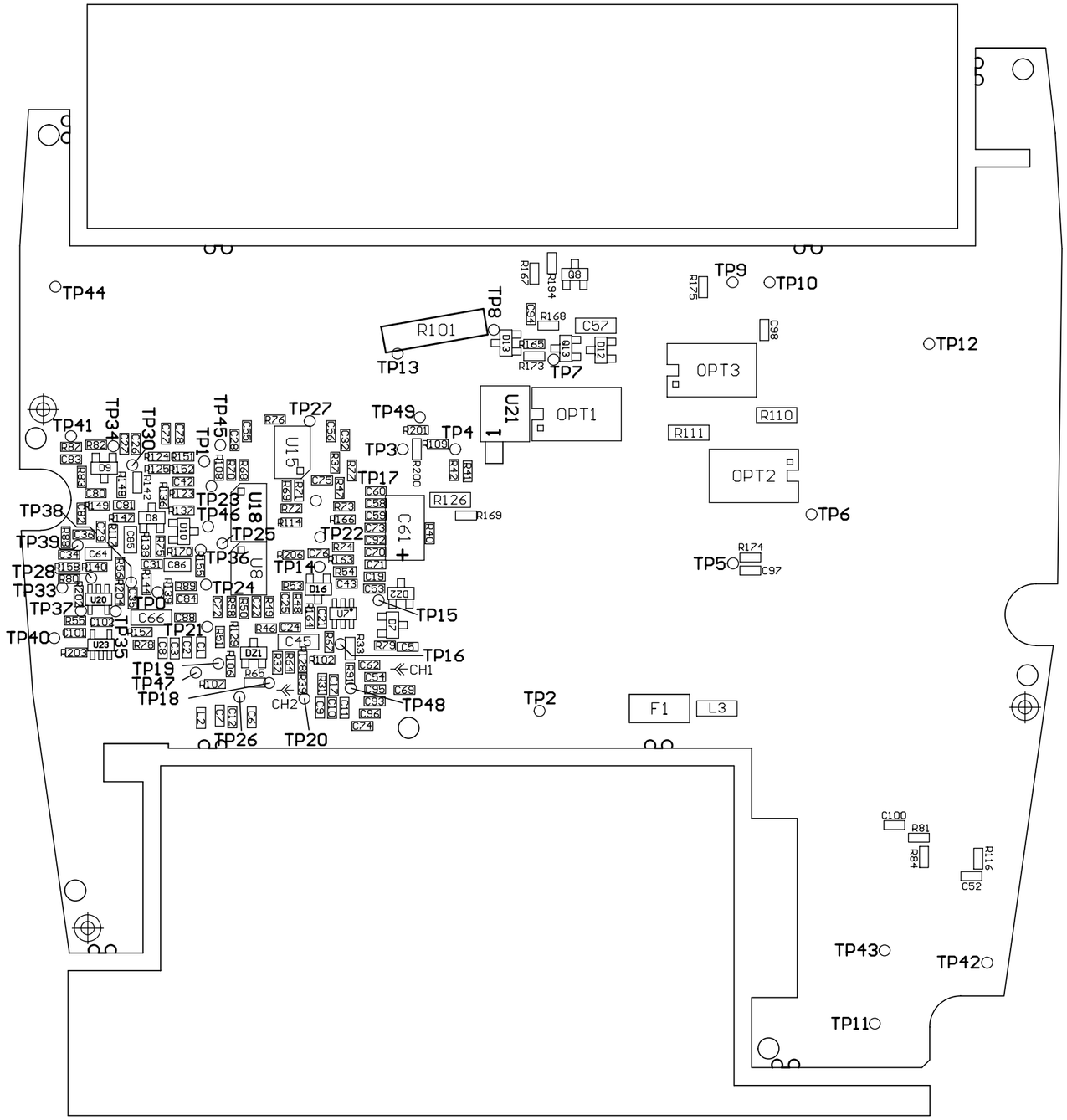
Project: EASY PORT					
Visum:	Drawn By: NF/HS	Entw.	Prod.	Date 01.03.04 Sheet 1 of 2	



Title: DE3–2				D.2628BA	Schiller AG Altgasse 68 CH–6340 Baar
Project: EASY PORT					
Visum:	Drawn By: NF/HS	Entw.	Prod.	Date 01.03.04 Sheet 2 of 2	